

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

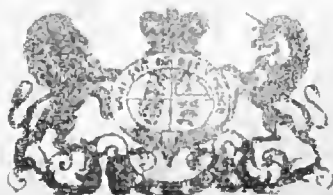
FOR THE YEAR

1900

BY

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Director.



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Annual Report on the Botanic Gardens, Singapore.

Staff.

1. There were but few changes in the Staff during the year. The plant-collector KASDANI proved very indolent and was discharged, a former peon IDRIS being taken on in his place. The Garden's peon was discovered to be stealing and suppressing letters entrusted to him to post, and was arrested and charged at the Magistrate's Court and sentenced to nine months' imprisonment. The coolies worked well, but the supply of good labour is very short, and the price of labour is very high now. The watchmen were a very poor lot and had to be constantly changed. In fact, the class of labour all round is very inferior to what it formerly was, and it is nearly double the price.

Visitors.

2. The number of visitors was unusually large chiefly on account of the large number of persons passing through to China, and the Philippines. There were also an unusual number of Scientists who visited the Gardens. The Regimental Band played as usual on moonlight nights and was highly appreciated. Beyond the theft of four small palms and a few flowers there were no thefts and no prosecutions.

Aviaries.

No additions were made to the aviary buildings during the year, except a few small additional enclosures for special animals. The following animals and birds were added to the collection:—An Albino Porcupine with a normal young one (*Hystrix longicauda*) purchased. A Philippine Deer (*Cervus moluccanus*) presented by Madame HINNEKINDT. One Bornean bear presented by Capt. CUMMING (died shortly after). One Kijang (*Cervulus Muntjac*) female, presented by AHMAT BIN HADJI OMAR. One Mias (*Simia Satyrus*) presented by Mr. DITTMAR. One Slowloris and young (*Nycticebus tardigradus*) presented by CUSTAWI. One Indian Mongoose male, presented by YEO CHEOW BOCK. One Cuscus (*Phalangista* sp.) purchased. Two hybrid Monkeys, one Kijang, and one common Deer were born. During the year two Rhinoceros (*R. sumatrensis*), were on deposit in the Gardens by Mr. PUSTAU. One died from injuries received in trapping, but one was thoroughly healthy and was eventually shipped to Vienna. These animals created a great deal of interest in the public who came in crowds to see them. Among the birds a black Adjutant was presented by GARASAMY PILLAI. One Cockateel presented by Mr. W. NANSON. Two Egrets from Sumatra presented by AHMAT. Three young Owls presented by Mr. BODEN KLASS. One Eagle by Mr. T. BIN CHING. Six whistling Teals, by Mr. A. F. BISCHOFF. Four Christmas Island Pigeons (*Carpophaga Whartoni*) presented by Mr. CLAYTON. One Pergam *Carpophaga aenea* presented by Mr. THOMAS. Four Cassowaries, purchased. A short-eared Owl *Asio accipitrinus* caught in Singapore, the first recorded for this region was purchased.

Reptiles.

One *Python reticulatus* presented by Hon. W. EGERTON. One large *Python curtus* captured at Bukit Timah. One large Tortoise (*Testudo emys*) was obtained at Batu Pahat during an expedition there, and another fine specimen was presented by YEOH KOK CHY, from Telok Anson.

The mortality among the animals was no greater than in former years, and, as usual, chiefly occurred in newly imported animals, which often are sent in in a sick condition; others died apparently from old age among which was a jungle pheasant which had been in the Gardens for over 18 years.

Flower Show.

An exhibition of flowers and flowering plants was held in the Town Hall on April 10th. The plants shown in most classes were not up to the average of past years, though some classes, such as ferns and begonias, were very fairly well shown. There was however a deficit on the working expenses.

Upkeep and Buildings.

The chief building alterations were the reconstruction of the back of the large plant-house, the old wooden posts and ataps were removed and the aisles roofed with chicks from Penang, supported on iron pillars. The old Beaumontia, which climbed over the roof was lowered when the roof was taken away and supported on an arch made of rough coral, in the interstices of which ferns and other plants have been planted. A tank for water-plants was made at one end of the plant-house and has been very attractive. The old wooden tables which used to carry smaller plants in pots were removed and replaced by permanent brick and cement structures which add much to the ornamental appearance of the house. Four additional long coral and cement tables were made in the Nursery, with brick pillars and iron arches to carry chicks or battens which will form a large addition to the space required for pot-plants.

The beds, borders and shrubberies were renewed as required, and manured and cleaned at intervals. About a hundred yards of road running down from the main hill towards the lake was remetalled.

Plants in flower.

The following were among the more interesting of the plants which flowered for the first time in the Gardens. *Camænsia maxima* (West Africa), *Vatica Wallichiana* (Malay Peninsula), *Ilex nigro-punctata* (Brazil), *Ravenia spectabilis* (Cuba), *Solandra grandiflora* (South America), *Ixora barbata* (India), *Bignonia incarnata* (Guiana), *Gymnostachyum Ceylanicum* (Ceylon), *Bignonia* n. sp. (Penang), *Dammara robusta* (Australia), *Aristolochia saccata* *Clerodendro* n. sp. (Borneo), a most remarkable climber with the terminal leaves on the flowering spray of a beautiful red colour *Cleistanthus parvifolius* (Pahang), *Triomma malaccensis* (Singapore).

Korthalsia Scaphigera *Dendrobium refractum* *D. Foxii* n. sp. (Perak), *Cyanastrum cordifolium* (Africa), *Hæmanthus Lindenii* (Africa), *Arisæma Roxburghii* (Penang), *Amomum* n. sp. (New Guinea), *Habenaria Columba* n. sp. (Siam), *Amorphophallus giganteus* and *A Titanum* flowered again.

Plants received and distributed.

During the year there were received 337 packets and bags of seeds, 600 plants and tubers besides the monthly supplies purchased from Messrs. CARTER & Co. Among the seeds of importance were 8 bags of mahogany and 5 lbs. of *Pterocarpus Macrocarpus* from Dr. PRAIN of Calcutta. Some rare palm seeds from HERR WENDLAND of Hereenhausen and Prof. CORNU of Paris. Of the new plant introductions the most valuable from an economic point of view came from the Royal Gardens Kew; amongst them being a new Coffee, and a new variety of Cocoa, a new African rubber *Landolphia Klainei*, some interesting palms and a new pisang, *Musa Livingstonei*.

The finest introduction of ornamental plants was a fine series of nymphæas from Messrs. HENRY A. DREER of Philadelphia, U. S. A., which have flowered very freely, and made our lily ponds a beautiful sight in the early morning.

The contributors were as follows:—

The Royal Gardens, Kew.	Messrs. Herb & Wulle.
Botanical Gardens, Buitenzorg.	Messrs. Dammann.
" Melbourne.	T. W. Brown, Esquire.
" Trinidad.	J. S. Goodenough, Esquire.
" Berlin.	M. Cornu.
" Queensland.	M. Vernet.
" Ootacamund.	Messrs. Williams Bros.
" Ceylon.	St. V. B. Down, Esquire.
" Calcutta.	E. R. Salisbury, Esquire.
" Old Calabar.	J. Pereira.
" Sydney.	W. D. Barnes, Esquire.
" British Guiana.	H. Wendland, Esquire.
Conservator of Forests, Dehra Dun.	W. Meikle, Esquire.
" Chittagong.	Dr. Braddon.
H. A. Dreer, Philadelphia.	C. Curtis, Esquire.

There were 399 plants and 134 packages of seeds sent out to various gardens and contributors besides those sent to planters and others in the Colony and Native States. Five Wardian Cases of fruit trees and economic plants were sent to His

Excellency the Governor of British New Guinea, and seven cases of various economic plants to the Congo Free State. A Collection of 69 packages of Carpological specimens was sent to Messrs. HERB & WULLE in exchange for living seeds of cultural plants.

Artist.

The Artist CHOUDHURY was employed in making drawings of interesting plants till July when he was attacked by brain disease and became insane. He was sent to the Asylum and eventually returned to Calcutta. CHARLES d'ALWIS was transferred from the Public Works Department where he had been employed as photographer and commenced work here on November 1st.

Vote	...	...	...	\$ 700.00
<hr/>				
<i>Expenditure.</i>				
Salary of Artist	...	...	...	\$ 450.00
Purchase of Colours, Brushes, Pencils, Rubbers, &c.	...	...	...	\$ 33.35
Balance	...	...	...	\$ 216.65
				<hr/>
				\$ 700.00
				<hr/>

Herbarium.

A small number of plants were collected in Malacca and Province Wellesley during my visit in the spring, and an extensive series were obtained during an expedition to Batu Pahat, and also at Panchur on the Johore River. Thirty-three specimens were received from Mr. CURTIS from Penang, and a very interesting collection of 122 specimens was presented by Mr. W. D. BARNES, from Kluang Terbang in Pahang at an altitude of 5,000 feet. Forty-four specimens from the collections of Scortechini were received from Calcutta. Two hundred and seventy-nine Australian and Polynesian ferns and other plants were received in exchange from the Botanic Gardens, Sydney.

Twenty-six specimens of Dichopsis, and Verbenaceæ were received from the Botanic Gardens, Buitenzorg.

The following were distributed to various establishments:—878 specimens to the Royal Gardens, Calcutta, 143 plants and 24 specimens of woods to Kew, 65 specimens and 82 samples of woods to the British Museum, 227 specimens to the Botanic Gardens, Sydney, 12 specimens of sea-weeds to Mr. E. HOLMES for identification, 24 specimens of Dipterocarpeæ to Dr. HEIM of Paris. Twelve pounds of bark of *Roucheria Griffithiana* stated to be poisonous were sent to Dr. GRESHOFF for analysis.

A number of local wood specimens were added to the collection, including a specimen of Chandan presented by Mr. W. D. BARNES and specimens of Perak and other woods obtained by Mr. H. C. HILL, and a specimen of fossil wood presented by Mr. WALSH.

Library.

The following books were added during the year:—

Greshoff Dr.—Indische Vergift rapporten. Presented by Author.

„ Nuttige Indische Planten.

Smith, E. F.—Wilt disease of Cotton, Water-melon and Cowpea. Presented by [Author.

Carleton, M. A.—Cereal rusts of the United States.

Hables, W. H.—A contribution to the Mineralogy of Wisconsin.

Cornstock, G. C.—Studies in Spherical and Practical Astronomy.

Weidman, S.—On Quartz and Keratophyre and Associated rocks.

Schlundt, H.—On the speed of the liberation of Iodine.

Barnes, C. R.—Analytic key to the Genera and species of North American Mosses.

Vernhout, Dr. J. H.—Onderzoek over Bacteriea by de Fermentation der Tabak.

Maiden, J. H.—A second contribution towards a flora of Mt. Koscinko.

„ Some exotic grasses.

„ Native Food plants.

„ The Noogoora-burr.

„ A new variety of *Dendrobium undulatum*, Useful Australian plants, (eight tracts).

Lotsy, Dr. J. P.—Physiologische Proevengenom met Cinchona.

Schiffner, Dr. V.—Die Hepaticæ von Buitenzorg.

Knapp, S. A.—The present state of Rice-culture in the United States.

- Kamer, G. and Zehnter, L.—Archief voor de Java Suiker-industrie.
 Raciborski, Dr. M.—Parasitischen Algen und Pilze Java's.
 Zimmerman, Dr. A.—De Nematodea der Koggie Wortels.
 Christ, L. and Warburg, O.—Filices Faurieanæ.
 Trimen, Dr.—Handbook of the Flora of Ceylon, part 5.
 Handbook of Jamaica. Presented by Royal Gardens, Kew.
 True, A. C.—Organization Lists of the Agricultural Colleges and experimental Stations of the United States.
 Hicks, G. H.—The germination of seed.
 Kramers, J. G.—Andere mededeelingen over Koffie.
 Godefroy le Beuf, A.—Les Caoutchoucaniers Du Para, Ceara, Panama, de Pernambouc, de l' Afrique, Le Balata, Le method de culture de Para. Catalogue des plantes utiles.
 Vernon Baily.—North American Fauna.
 Palmer, T. S.—The germination of seeds.
 Shea, V. O.—Aspects of mental economy.
 Miller, W. S.—Contributions from the Anatomical Laboratory Wisconsin.
 Maxwell Lefroy, H.—Moth-borer in sugar-cane. Presented by the Commissioner for the West Indies.
 Deane, H. and S. H. Maiden—Observations on the Eucalyptus, part V. VI.
 Dyer, Sir W. Thiselton.—Flora of Tropical Africa, Vol. V. Presented by the Government.
 Andrews, C. W.—Monograph of Christmas Island. Presented by the Trustees of the British Museum.
 King, Sir George.—Materials for a flora of the Malay Peninsula.
 Woods, A. F.—Stigmonose, a disease of Carnations.
 Romburgh, Dr. P. V.—Caoutchouc en Gutta Percha in Nederlandsche Indie.
 Kearney, T. H.—The plant covering of Ocracoke Island.
 Mohr, J.—Overhet Drogen van de Tabak.
 Hart, J. H. and P. Carmody—Seedling canes of Trinidad.
 Bijlert, A. V.—Over Deli-Groud en Deli Tabak
 Boerlage, J. G.—Flora van Nederlandsche Indie.
 Beale, F. E. L.—Food of the Bobolink.
 Webber, H. J.—The immediate effect of Pollen in maize.
 Schreuk, H. V.—Two diseases of red cedar.
 Galloway, B. T.—Progress of commercial growing of Plants under glass.
 Progress in the treatment of plant diseases.
 Webber, H. J. and E. A. Bessey, —Progress of plant breeding.
 Schmidt, J.—Flora of Koh Chang, part I.
 Heern, G.—Catalogue of Welwitsch's African plants.
 Greshoff, Dr.—Beschrijvingder giftige-planten bij den vischvangst.
 Merrian Hart.—Results of a Biological Reconnaissance of the Yukon River.
 Wood, J. Medley—Natal plants, Vol. 2. Part 2. Vol. 3. Part 1.
 Hitchcock, F.—Trade of the Philippine Islands.
 Our Foreign Trade in agricultural products, 1890-1898.
 Trade of Puerto Rico.
 Section of Foreign Markets.
 Magnussou, C. E.—Anomalous dispersion of cyanin.
 Istvanffi, Dr. G. de—Une visite au Jardin Botanique-de kolosvar.
 Wildeman, E. and Durand.—Illustrations de la Flore du Congo.
 Christ, H.—La question des petites espèces.
 Palmer, T. S.—Legislation for the protection of birds.
 Koorders and Valetton.—Boom sorten op Java.
 And the following serial publications:—
 Journal of the Board of Agriculture, Experimental Station Records (America), Annales du Jardin Botanique, Journal of Agriculture for Zanzibar, Planting Opinion, Notizblatt (Berlin), Queensland Agricultural Journal, Bulletin Economique de l'Indo-Chine, Der Tropenpflanzen, Koloniaal Museum Haarlem, Jamaica Bulletin, Agricultural Ledger, Indian Museum Notes, Chemist and Druggist.
 Agricultural Journal of the Cape of Good Hope, Icones Bogorienses (fasc. 3)
 Trinidad Bulletin, Mercks Annual Report and Digests, Pharmaceutical Review,

Buitenzorg Bulletin, West Indian Bulletin, Revue des Cultures Coloniales, Acta Horti Petropolitani Transactions of the Botanical Society of Edinburgh and Garden and Forest Reports of South Australia, Queensland, Barbados, Trinidad, Mysore, Ceylon, Hongkong, British Guiana, Natal, Madras (Forest Department), Calcutta, Tenasserim Agrihorticultural Society.

Purchased.—Journal of the Royal Horticultural Society, 14 volumes. Gardener's Chronicle Botanical Magazine. Journal of the Linnean Society. Tropical Agriculturist. Dictionnaire Iconographique des Orchidees for the year.

Bulletins.

A bulletin dealing with Native Rubbers Insect Pests including the outbreak of the bee-hawk moth in Selangor, *Kickxia Africana*, notes on Para Rubber, injurious fungi and other subjects was published in May. A paper on Dammars and Wood-oils, was prepared and printed in the Journal of the Straits Asiatic Society. Another bulletin on the Timbers of the Malay Peninsula was prepared and will be printed in the following year.

Expeditions.

In the early part of the year I accompanied Mr. H. C. HILL in his tour of inspection in the Colony, and in November made a botanical expedition to Batu Pahat in Johore. Arriving there on October 31st, and remaining till November 18th. During this time I explored the hills, Gunong Banang, Pengaram and Soga, and ascended the rivers Sempang Kiri and Sempang Kanan, ascending the latter as far as Tebing Tinggi for two days, and exploring also the rocks at the mouth of the Batu Pahat River at Bata. Although the collector I took with me was ill and almost useless the whole time I obtained a large series of plants from this hitherto unexplored district, including many new and rare plants. The highest hill in this district is Gunong Banang, 1,500 feet, and I had expected to find a flora resembling at least the lower part of Mount Ophir, but there were but few hill forms to be met with. The most striking tree was a very tall *Podocarpus*, evidently the same species as the one on Mount Ophir but attaining a very large size. A new *Bromheadia*, *Sonerila*, and a number of other small plants were obtained here, but the flora was much less rich and striking than that of Gunong Pantii, a hill of no greater size on the west of the Peninsula. The general aspect of the flora of this district is that of Singapore with however a number of additional forms, and the remarkable absence of others. This is a great contrast to the flora of Eastern Johore which resembles that of Pahang. In fact the Flora of the Peninsula may be said to be divided into two by a line running down the centre of the Peninsula.

Besides herbarium specimens, a number of living plants, orchids, etc., and a very fine Tortoise *Testudo Emys* captured at Batu Pahat were brought to Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1900.

RECEIPTS.		EXPENDITURE.			
	\$ c.	Salaries.	\$ c.	\$ c.	
By Balance in Bank ...	2,891 42	Clerk	284 00		
„ Government Grant	9,150 00	Mandores (three)	484 44		
„ Sale of Plants, Seeds		Carpenters (two)	291 66		
and Flowers ...	2,703 10	Masons, (two)	183 36		
„ Interest ...	49 20	Label Printer	120 00		
		Plant-collector	118 33		
		Peon	103 28		
		Aviary-keeper	96 00		
		Police	331 65		
		Coolies	3,347 09		
		Rice Allowance	662 29		
				6,022 10	
		Bills.			
		Tools and Stores	913 33		
		Laterite, Gravel, Sand,			
		Bricks, etc.	338 27		
		Timber, Planks, Laths, etc.	390 41		
		Pots and Tubs	117 56		
		Birds' and Animals' Food	1,539 33		
		Manure and Cartage	218 87		
		Buildings and Repairs	569 66		
		Freight on Plants, etc.	182 26		
		Books and Papers	302 65		
		Plants and Seeds	387 40		
		Subscription to the Telephone	90 00		
		Wardian Cases	121 50		
		Petty Expenses	268 22		
		Miscellaneous	297 90	5,747 36	
		Balance in Bank ...	...	11,769 46	
				3,024 26	
	\$14,793 72			\$14,793 72	

Economic Gardens.

A considerable portion of ground covered with scrub lying adjacent to the Bukit Timah Road was cleared and planted with Para Rubber stumps and seedlings which have thriven well. The Merabau trees in the remaining portion of the scrub were cleared round and the ground opened up. A band of scrub was cleared along the Eastern boundary of the Garden for planting *Castilloa* as it seemed the most suitable spot for it. A number of cuttings of *Ficus elastica* were planted in various spots, for experiment, many trees were added to the arboretum. Among the Economic plants received during the year were—*Pachylobus edulis* from Calabar, *Coffea Laurentii-robusta*, *Theobroma pentagona*, *Landolphia klainei*, and *L. Owariensis* from Kew; *Kickxia elastica*, of which three lots of seeds were received from different contributors, but unfortunately none germinated. This is the tree which produces the Kickxia Rubber of Africa and not the *K. Africana* which was previously distributed from Europe.

The large fruited bamboo *Melocanna bambusoides* was sent by the Chittagong Forest Department.

Para rubber.—The demand for seed showed no signs of diminishing. During the year 145,600 seeds and 6,400 plants were distributed as follows:—6,000 plants and 46,750 seeds to the Colony, 79,350 seeds to Selangor, 17,500 to Johore and a few to Sumatra, in exchange for Gutta Percha, and to Pahang.

The number of planters in the Colony does not increase and the demand for seed in the early part of the year when the crop was at its greatest was not large. The interest in its cultivation generally, has however, shown no signs of diminution and is only checked by the insufficient supply of seed.

The trees fruited more or less all through the year, the largest amount of seed being obtained in September and October.

The chief enemy complained of by planters was the termite, *Termes Gestroi*, which has done a good deal of damage in different parts of the Peninsula to young trees. It coats the outside of the tree with mud up to a height of some feet, and also burrows up the centre. This termite however is an inhabitant of dense jungle rather than of cleared ground and will probably disappear altogether when the ground has been under cultivation for some time.

Further experiments were made in tapping trees, and in the preparation of the rubber by Creosote. It was found that one or two drops of Creosote dropped into the latex prevented decomposition and no odour was produced during drying. It made no difference in the colouring of the rubber which eventually became as dark as rubber not so treated.

The Creosote however had a tendency to make the rubber sticky, and more than one or two drops produced an objectionable amount of stickiness. Whether creosoting the rubber improves it from a commercial point of view remains to be seen.

In July an average sized tree measuring 60 feet in height, with a circumference at the ground of 5' 5" and a clean stem up to 10' 3" from the ground, approximate age 12 years, was selected for tapping with a view of seeing what could be got out of it irrespective of any conditions, in other words to bleed it to death if necessary. The experiment began on the 5th of July, and was carried on until the 27th September, a period of 84 days on which date the latex ceased to flow. Throughout such a long period as might be supposed all kinds of weather was experienced, from very dry to very wet. On the whole, however, it can be said that the prevailing conditions were comparatively dry, for out of the 84 days on 71 very little or no rain fell at all. The total rainfall registered during the full period being 18.07. The method of tapping was that usually practised, *viz.*:—longitudinal incisions of a V shape fed by similar incisions about a foot apart. The receptacle in which the latex was collected was a small cigarette tin, with a lid on in such a way as to admit of the latex running in whilst keeping out the rain, notwithstanding this, however, a certain quantity of water did get in the tins during wet weather, as will be seen by the great difference in weight between the wet and dry states of the rubber; the total in the wet state being seven and-a-half pounds and in the quite dry three pounds only. The greatest yield in twenty-four hours was 6 ounces on July 12th, and the smallest $\frac{1}{2}$ an ounce on the 28th of the same month. On four days out of the total there was no flow of latex at all, of these four days, three were wet and one dry. The quality of the rubber was necessarily of a scrappy nature, especially when quantities of less than an ounce was taken per day, whereas quantities over an ounce consolidated into nice little cakes. As regards coagulation no difficulty whatever was experienced, a few hours being sufficient to coagulate the latex to the consistency of soft cheese, and as regards the offensive odour due to the decomposition of the proteids it was found that a couple of drops of Creosote was sufficient to entirely get rid of the bad smell. On the whole the experiment may be said to have proved—1st, That three pounds of dry rubber can be obtained from an average tree—whether this quantity can be taken yearly remains to be seen—that it could be taken every other year, one is safe in predicting from our knowledge gained of the time other trees have healed of their wounds. 2nd, That it does not appear to injuriously affect the tree in the slightest.

Insect Pests.

A number of injurious insects were reported on by planters and remedies for them suggested. Among the important ones were *Batocera octomaculata*, a large longicorn beetle, the grubs of which bore up the stems of various species of *Ficus*, and among others the Rambong, being a very large insect it is easily caught and destroyed, but in large Rambong Estates it might prove very destructive. The life history of the *Crinum* caterpillar which destroys the *Crinums* cultivated for ornament was worked out, it proved to be the larva of a noctuid moth *Calogramma festiva*.

An obscure disease of the shoots and leaves of *Ficus elastica* was reported from Muar. It was partly due to a leaf fungus, specimens of which were sent to Kew for identification :—

Vote for upkeep of Economic Gardens	...	\$2,200
<i>Expenditure:—</i>		
Salaries of Mandore and Coolies	...	2,002.63
Tools and Stores	...	113.17
Manure	...	30.00
Sand	...	7.50
Purchase of plants	...	26.40
Balance	...	20.30
		<hr/> 2,200.00 <hr/>

Inspection of Coco-nut trees.

During the year, 699 trees and 21 piles of rubbish containing or likely to contain beetles destructive to coco-nut trees, were destroyed, and 266 trees were destroyed on abandoned ground chiefly at Teluk Kurau by a coolie employed for the purpose till July. Notices were served on 156 persons and there were no prosecutions.

There is, I think, no doubt that the number of red beetles has considerably diminished in Singapore. They seem to be comparatively rare now. The destruction of abandoned trees and trees in neglected patches is I think responsible for this.

Vote	...	\$486.00
<i>Expenditure:—</i>		
Salaries of		
Inspector, climber and cooly	...	324.00
Transport	...	141.76
Uniforms	...	12.75
Balance	...	7.49
		<hr/> \$486.00 <hr/>

Gutta Percha and Rubber Planting.

The small vote for this purpose allowed of three men being employed to clear the forest on the lower slopes of Bukit Timah, and plant as many trees of Getah Taban as were procurable. The plants planted on the previous year were cleared and replaced where they had died as far as possible, and the trees growing in the forest on the Eastern slope were inspected, the shrubs and jungle trees which were crowding them out were cleared away, and a number of over-crowded young plants were removed from that locality and transferred to the new plantation. The ground on the left side of the road going up to the Bukit Timah Hill proved less suitable for the growth of Getah Taban than was expected, and although a few plants planted on the previous year made a very good growth, one attaining a height of nearly 8 feet 6 inches and several from 3 to 5 feet; the others made a much slower growth, and at one part a large number died. It became clear that the plant requires at least, at first, partial shade and is better grown in secondary growth, sufficiently cleared to allow light to reach them. Hills sloping to water courses covered with thin wood suits the plant better than anything else, provided that they are not planted too close to the water. Suitable ground was found on the right side of the road, and here the fern was cut down and spaces cleared so as to plant as many as could be procured. In the meanwhile steps were taken to secure as many plants as possible and with the aid of a small vote for purchase of seeds and plants, 2,300 seedlings were obtained, and 720 stumps were presented by M. LE COMTE D'ABBANS. These were not sufficiently far advanced in growth to plant out till the end of the year and the weather then being exceedingly dry was not favourable. They will be planted out in 1901. Besides these 1,400 stumps of Getah Sundik (*Payena Leerii*) were purchased and grown on so as to be ready for planting. This gutta is in demand for mixing with Getah Taban for cable purposes, the Taban not being sufficiently plastic alone. A few plants of *Dichopsis calophylla* came on previous occasions mixed with *D. oblongifolia*. This contains a valuable gutta, but less so than *D. oblongifolia*. It is evidently a stronger and more rapidly growing plant than *D. oblongifolia* and stands the sun much better.

At present it has been found impossible to procure seeds of *D. oblongifolia* or *D. Gutta*. Two trees in the Botanic Gardens flowered this year, one rather heavily, it however does not appear to have set a single fruit. At present the only way of procuring plants is to have them dug up from the forests in the form of seedlings or more commonly as young trees about $\frac{1}{2}$ to $\frac{3}{4}$ inch through or less. The tops of these are removed and the stumps with the tap root kept damp till they can be planted. These stumps after a period of 4 to 6 months put out strong shoots, but it is remarkable that the new rootlets do not appear usually till after the shoots have made some growth, and often one can find stumps quite leafy with hardly a visible rootlet. It is found advisable therefore to allow the stumps to remain a long time in the beds or boxes till they have put out strong roots as well as leaves before planting out. The plan of planting the stumps as received *in situ* in the plantation is now being tried, so as to avoid injuring the roots by moving.

The various forms of Marcottage have been tried on *D. oblongifolia* and *D. calophylla*. These are all successful in almost every case, the time required for the roots to be fully emitted so that the marcot can be removed, varies from 3 to 6 months.

For work on a large scale this method of propagation is too slow and expensive. Simple cuttings were also tried but though a few thus treated grew the percentage is too small to be a satisfactory method of propagation. Another method of propagation by laying the young plant horizontally and allowing it to throw up lateral shoots and then cutting the stem into segments each bearing a shoot has been tried with more or less success. This method has however given it is said good results in Sumatra, and plants so propagated have been received thence which are very strong and healthy, but it is noticeable in this case as in the matter of stumps that the proportion of roots produced is very small in proportion to the size of the shoot. The young trees planted in various exposed positions were found to suffer very much from the attacks of a caterpillar which spun the leaf shoots together and destroyed them. It is rather difficult to deal with as it escapes the action of insecticides by concealing itself in the spun-up leaf. Attempts to rear the caterpillar to the moth state failed. It was noticed that not only were young trees freshly planted attacked but even in the jungle when the surrounding vegetation was cleared so as to let in light the pest appeared on the trees in a very short time.

It is regrettable to have to record the destruction of five fine large sized trees in the Bukit Timah Forest by a party of Malays during the year, who destroyed also others in different parts of the Island. Two of the men were captured but with the present value of Gutta Percha, severer penalties and a more adequate staff of Forest Guards will be required to prevent the destruction of the remaining large trees.

The question of the name of the species common in the Malay Peninsula, whether *D. gutta* or *D. oblongifolia* has more than a botanical importance, inasmuch as the values and qualities of the produce of the trees known under these names have been stated to be different. Dr. ROMBURGH who visited the Gardens during the year affirmed that the old trees in the Garden were *D. oblongifolia* and not *D. gutta*. Specimens of the two species as known in Buitenzorg were supplied to the herbarium by Dr. TREUB, but I fail to see any tangible difference. The form of the leaves varies very much in different parts of the same tree and still more markedly with age, and the flowers of the tree identified by Dr. ROMBURGH as *D. oblongifolia* do not appear to differ from those figured as *D. gutta* in Dr. BURCK'S paper on Gutta Perchas. It is still more remarkable that the original *D. gutta*, which was originally obtained in Singapore and has now, according to the Buitenzorg botanists, utterly disappeared, although the *D. oblongifolia* which was discovered very much later is still comparatively abundant, and appears to have replaced it. Botanically speaking the question is of some importance and perhaps economically so, though it must be remembered that in any case at least the bulk of the trade Gutta Percha for upwards of fifty years or more has been derived from *D. oblongifolia*.

The trees of Para Rubber at Bukit Mandai were gone over by the men employed on the vote and all belukar trees which had come up among them and were interfering with their growth were removed.

Vote for timber planting.

The vote for planting valuable timbers in the forests, *viz.*, 300 dollars allowed of three men being employed on this work. The ground was cleared where necessary, in the same district of the Bukit Timah Forest Reserve which was selected for the planting of Gutta Percha, the ground unsuited for that plant being planted with timber

trees. Altogether an area of about 60 acres was opened up and planted and 15 acres planted on the previous year were cleared and the trees weeded. The chief trees planted were Mahogany (large-leaved) 17,600; Merbau 6,800; Eugénias and various plants 982; Rengas, (*Melannorhea*) 300, all raised from seed, and 1,380 Balam removed from the Botanic Gardens were also planted. The Mahogany and Merbau made very satisfactory growth and there were but few failures. The Merbau seed was found to do very well, planted at stake, without the necessity of raising in nursery beds and transferring later to the wood. A large quantity of seed of the small-leaved Mahogany was sent from Calcutta, but failed to germinate. The large-leaved kind is however in every way more suitable for cultivation, being more rapid in growth and altogether a stronger tree. A number of seeds of a *Shorea* found in fruit in the jungle were planted, but made very slow growth, and are not yet ready for transplanting, a few seeds of *Nyctia dolabriformis* the Pynkado and seeds of *Pterocarpus macrocarpus* the Padouk were sent from Calcutta and were planted and germinated well. Some thousands of seed of Kranji (*Dialium*) were purchased in the market where the fruit is sold for eating and germinated freely. This very valuable timber is of slow growth at first but increases more rapidly after a few years. The Merbau trees at Bukit Mandai and at the old plantation by the Bukit Timah Forest Station, were opened up, the scrub and other trees growing round them and interfering with their growth were removed, and the few billion trees on Bukit Timah which have survived the encroachment of fern and scrub were also cleared round, and have already shewn signs of increased growth, unfortunately the greater number planted in 1884, succumbed to want of clearing in the following years.

Mr. HILL during his visit to Singapore inspected the planting on Bukit Timah, and made many valuable suggestions which are being carried out as far as possible.

Vote	...	...	...	...	\$300
<i>Expenditure:—</i>					
	Salary of 3 coolies	...	...	...	252.14
	Transport	...	...	...	9.39
	Cart hire	...	...	...	7.50
	Rent and 'rikisha hire	...	...	...	21.00
	Balance	...	...	...	9.97
					<hr/>
					\$300.00

Government House and Domain.

The Mandore, ROGERS died in May and as there was some difficulty in getting a suitable man to replace him, the Mandore ANIFF was transferred till a man had been trained for the work, and remained there till the end of the year. The coolies worked satisfactorily and the gardens and park looked well.

Vote...	...	...	...	...	\$2,360.00
<i>Expenditure:—</i>					
	Salaries of Mandore and Coolies...				\$1,974.89
	Tools and Stores	...	...	...	231.48
	Hand Cart...	...	...	...	29.00
	Lawn Mower	...	...	...	27.00
	Pots and Tubs	...	...	...	87.00
	Manure	...	...	...	7.60
	Balance	...	...	...	3.03
					<hr/>
					\$2,360.00

Botanic Gardens, Penang.

Waterfall Gardens.

For several years there has been no change in the staff of this Garden. MAHOMAD HANIFF, Overseer, and MAHOMAD HUSSAIN, Propagator; the two men on whom the working of this Garden devolves during my absence on other duties both served three

years' apprenticeship here before obtaining their present appointments and are useful men. As I have been absent from Penang about a month and-a-half at different times during the year I wish to record the satisfactory manner in which the work has been done during my absence.

2. Besides other work MAHOMAD HUSSAIN has made a considerable number of drawings of new or imperfectly known plants in which he is sufficiently proficient to make it desirable that his whole time should be devoted to this work.

3. The supply of gardeners and coolies is by no means all that could be wished. Changes are frequent and at times it has been difficult to obtain sufficient labour owing to the demand for railway and other work where the pay is better, and this is the experience of most persons engaged in Agricultural pursuits.

4. Since the German line of Steamers commenced calling at this port, the number of European travellers visiting this Garden has increased, as many as twenty gharry-loads sometimes coming from one of these boats, and there has always been something of interest for them to see.

5. On the whole I think the Orchid House has been brighter this year than usual. From July to the end of the year one of the side stages was kept full of flower with large number of *Calanthe veratrifolia*, *C. vestita*, *C. rosea*, *C. rubens*, *Habenaria*, *Carnea* and *Phalænopsis violacea*; with which were interspersed in lesser numbers as they came in flower such things as Angrecums, Cattleyas, Vandas, Dendrobiums, Aërides, Erias, *Miltonia Roezlii*, *Dilochia Cantleyii* and various others.

6. While devoting a good deal of attention to the cultivation and determination of plants of botanical interest from the surrounding Islands and mainland, the more showy, and to some visitors the more interesting, garden forms are not neglected. Caladiums, of which we have a first class collection, are well grown and much admired, and the same may be said of Palms, Ferns, Aroids and other ornamental foliage plants. Flowering plants, especially Annuals, are not easy to grow during the rains, but from November to March we can do a good many things that it is quite impossible to grow satisfactorily during the other months.

7. Contributions of plants or seeds have been received during the year from the Royal Gardens, Kew, the Botanic Gardens, Calcutta, Ceylon, Singapore, Brisbane and Hongkong. The Agri-Horticultural Societies of Calcutta, Rangoon, and Madras; from Messrs. F. SANDER & Co., Messrs. JAS. VEITCH & SONS, Messrs. DAMMAN & Co., Messrs. CHATTERJEE and C. MARIES. Other contributors are Messrs. BAKER, Perak, BUTTIKOFFER, Sumatra, BURCKARDT, Sumatra, BIRCH, Penang; CUNDALL, Manila, DERRY, Perak, GOLDHAM, Perak, HALLIFAX, Dindings, LOGAN, Penang, MOORE, Rangoon, PECHE, Moulmein, SCHMIDT, Sumatra, STEPHENS, Perak, VERSMANN, Sumatra, YAPP, plants from Gunong Inas.

8. Of recently introduced economic plants, the most promising is *Kickxia Africana*, of which six small plants were brought from Kew in November, 1899. After nursing these in pots for two months they were planted out and the largest is now over four feet high with a stem nearly an inch in diameter. *Landolphia florida*, obtained from Kew at the same time; has made shoots twelve feet long and commenced twining up the trees. *Castilloa elastica* does no good in this Garden. We have tried it in both sun and shade but it refuses to make progress under either condition.

9. Improvements and extension of the Garden, so far as funds permit, have been carried out, but the extent is limited as the Government Grant for Maintenance remains the same as it was nine years ago, while labour and every article that has to be bought has considerably increased in price.

10. One of the old wooden span-roofed plant-sheds in the Nursery, fifty feet long and eighteen feet wide, has been renewed with iron supports and roof, covered with bertam chicks, and the beds on which the plants are set reconstructed with rough soft granite covered with *Selaginella serpens*. Nearly sufficient iron has been accumulated to construct another and larger shed during the current year when the land now owned by the Tramway Company has been acquired.

11. The large iron plant-shed in which the plants are all grown in rock-work has been gone through, overgrown specimens removed to more suitable quarters and the others re-planted and manured. In this shed are some fine tree ferns and shade loving palms. New beds have been made and planted up with miscellaneous flowering shrubs, and a great number of Palms and trees of various kinds planted out in different parts of the grounds.

12. Three old bridges have been reconstructed in stone and iron which is a permanent improvement and completes the bridging of the one and-a-half mile of carriage road within the Garden. There are now three bridges of stone and iron spanning the main stream which bisects the garden, and three on the tributary sources which are practically dry at certain seasons. Five hundred and fifty lineal feet of carriage road, thirteen feet six inches wide, have been entirely remetalled and other parts repaired.

13. No special excursion for collecting botanical specimens has been undertaken by myself this year, but on each occasion I have gone out on forest duty. I have taken the necessary apparatus and a collector and added considerably to the collection of specimens in the herbarium, and to plants in cultivation in the garden. In September, the Overseer, MAHOMAD HANIFF, went out to the Lankawi Islands for a fortnight, but the monsoon was blowing so strong at the time that he found it impossible to get far. I am of opinion that if one could get about there in the middle of the rains, there are many interesting deciduous rock plants to be collected that one never sees in the dry season, but I know from experience that boating at that season is difficult and dangerous. However, he brought back several interesting plants some of which have since flowered and two of the Orchids, a *Bulbophyllum* and *Dendrobium*, have been described by Mr. RIDLEY in manuscript as new species.

14. The expenditure on this Garden during the year amounts to \$4,497.44 as shown in Appendix A, and the Revenue derived from sale of plants and use of Swimming Bath to \$588.20. This expenditure covers the cost of renewal of plant-shed, remetalting of roads and in fact all matters except the construction of bridges which was a budget item and carried out by the Public Works Department. The amount collected as revenue has been paid in weekly to Revenue Account.

Governor's Hill Bungalow Garden.

15. Mr. O'KEEFE returned from leave and resumed duty on the 2nd February and has, in addition to his own duties, been acting as Signal Sergeant since the end of May. He reports having been handicapped as regards coolly labour during the last three months in the year, being for some time three and four men short out of a staff of seven, which he attributes to higher pay being obtainable elsewhere.

16. The rainfall was less than in the previous year by about 30 inches, the wettest month being September with 33 inches, and the driest, December with 1.27 inches only.

17. With an adequate supply of manure and water a great many kinds of European Vegetables and flowers can be grown on this hill from November to March, but the present cost of carrying up manure is prohibitive, and when the rainfall falls to a point so low as in December last the rain water tanks on which we are dependant for gardening purposes become exhausted and it then requires all the available labour to carry from the nearest spring enough water to keep things alive. When the hill railway is made, it is hoped that the first of these troubles will be overcome, and I hope that the time will then not be far distant when water will also be made more easily available.

18. No new work has been undertaken, the sum authorised for upkeep being barely sufficient to keep the grounds in order, to grow enough ornamental plants for house decoration when the Bungalow is occupied, and maintain a regular small supply of vegetables. When the railway is made the hill will be largely visited by travellers passing through as well as by residents in the Island, and in that case more money should be spent in making the hill attractive.

Experimental Nursery.

19. The experimental Nursery on Government Hill has been practically abandoned for two years and steps are now being taken to re-afforest the site with useful trees.

Coco-nut Tree Preservation.

20. Mr. BALHETCHET, Inspector of Coco-nut trees, and two men have been employed six months in the year in Penang and six in Province Wellesley, in inspecting plantations, &c., and in serving notices on persons having on their premises dead trees or other matter likely to prove breeding places for beetles. The number of dead trees reported is less than in previous years and I believe this is

owing to diminution in the pest. Altogether 1,931 notices were served and twenty-nine persons prosecuted as shown below:—

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.
Province Wellesley. Northern District,	554	2,147	104	66	824	14	\$ 28 50
Province Wellesley. Central District,	194	436	69	49	306	5	14 50
Province Wellesley. Southern District,	97	183	49	44	94	Nil	Nil
Penang Island.	634	2,074	181	25	707	10	35 00
Total.	1,479	5,047	403	184	1,931	29	78 00

Forests.

21. In February I visited the Dindings to inspect some proposed additions to the Forest Reserves in that District on which I reported on my return and of which I attach a copy (Appendix B).

Visits were also made at the request of District Officer to Tassek Glugor and Bukit Panchor Reserves, Province Wellesley.

22. In accordance with instructions from His Honour the Acting Governor, I went to Malacca in May with five hundred plants of "Gutta Taban" (*Dichopsis Gutta* or *D. oblongifolia*) and selected two sites on which to plant them. These trees were planted out 20' x 20' in partial shade, the idea being to gradually cut away the surrounding "bluker" as the plants acquire strength. While these enquiries were made and samples collected of some of the local climbing rubbers, which together with leaf specimens were sent to Kew, and a report on these has already been published in the *Government Gazette*. The Forest tree Nursery at Ayer Kroh was also inspected and at the request of the Acting Resident Councillor a few simple instructions in writing drawn up for the guidance of the Overseer in charge.

23. From June the 18th to July 2nd, I was detailed to accompany Mr. H. C. HILL of the Indian Forest Department during his tour of inspection of the Forests of the Colony in Penang, Province Wellesley and the Dindings. Mr. HILL has since reported on these Forests and the manner in which they should in future be administered.

24. In September, I obtained permission to visit Perak for three days to make some enquiries and observations in connection with Gutta Percha, especially the hill forms. On my return I furnished a short report on this trip, a copy of which is attached (Appendix C).

Para Rubber.

25. In my last two Annual Reports I have furnished information as regards the method adopted and results obtained from tapping a single Para Rubber tree (*Hevea brasiliensis*) growing in the Waterfall Garden, and the matter is of so great importance to the Agricultural Community of the Colony and Native States that no apology is necessary for again referring to the subject and repeating to a certain extent what has already been recorded in these reports. The tapping of this one tree has now been continued over a period of two years and the result is such as to confirm the opinion that in this cultivation lies a source of wealth of the greatest importance. This particular tree is now fifteen years old and has yielded in two years twelve and a half pounds of dry marketable rubber without any apparent injurious result to the health of the tree. It is growing on a dry gravelly bank, not at all the sort of place I should select from choice, and is fifty-five feet high. At three feet from the ground it is sixty-six

inches in circumference and forks at three feet six forming two straight stems measuring at five feet from the ground, 42 and 32 inches in girth. The branches are not greatly spreading in proportion to its height and for trees of this size 20' x 20' apart gives ample room. This would give 108 trees to the acre and supposing them all to be equally as good as this one the result would be 675 lbs. of rubber per annum which at 3s 10d per lb. the price realised for three hundred weight sold in the London market by Mr. DERRY, Superintendent of Government Plantations, Perak, in April last, works out to over £129 per acre. It is not probable that all the trees on an estate would be equally good, in fact experience proves that there is a considerable difference, but Mr. DERRY informs me that in tapping once about a hundred trees in Perak, the average was three and-a-half pounds per tree, and much more could have been taken but it was feared that further tapping might interfere with the seed crop. This comes fairly near the result of our one tree which shows an average of three and one-eighth of a pound for each of the four tapplings. In addition to the experience gained in tapping this one tree over a period of two years, two other trees in a group of twenty planted 12' x 12' have been tapped once, the result being 2lb. 9 oz. of dry rubber from the two. These are comparatively small trees about forty feet high and measuring 23 and 25 inches in girth at five feet from the ground. They are the same age as the large one but have grown slowly as might be expected in the sort of place they are planted. I think that this result from trees of this size will appear perfectly satisfactory to planters some of whom I know base their calculations on one pound per tree per year after the seventh or eighth year, and in good soil I believe that trees equal in size to these two will be grown in that time. The cost of land, clearing, and planting, is well known to those interested in the matter and the question of more importance to them at present is the quantity of rubber to be expected and the cost and method of collecting it. I have already shown the result as regards quantity, and as regards cost the time occupied in collecting this 12½ lbs. occupied one man about 28 hours, but the cost of tapping small trees will be proportionally greater. The only other labour involved is smoke drying which if the rubber is rolled out into thin sheets is a simple and inexpensive operation, but should be done as soon as possible after coagulation. A good deal has from time to time been written about the particular kind of nut that is used in Brazil for this purpose but in a recent Consular Report by Mr. Vice-Consul TEMPLE on the state of Amazonas, Brazil, he says that it is a mistake to suppose that any considerable portion of the rubber exported is prepared in this manner and he further states that wood chips which give less trouble to procure are preferred which is what might reasonably be expected seeing that the thing has to be done quickly. I find Coco-nut husks answer the purpose admirably. The latex coagulates as a rule without any trouble but if it contains a large proportion of rain-water there are various chemical re-agents that will cause coagulation. Acetic Acid and corrosive sublimate are recommended, but I have only tried Alum and Spirits of Wine. The latter is instantaneous in its action and if it does not injuriously affect the rubber, and I do not think it does, it may open a market to the sugar planters for their spirit. As regards the method of tapping I have found no better than that described in my last year's report that is that after having made a certain number of V. shaped or herring bone incisions to continue working on the same cuts by removing with a sharp chisel a thin shaving from the lower surface on alternate days. Very little milk is obtained at the first and second operations, but after about the third time it begins to run freely as will be seen by the following record of each day's collection:—

Date of tapping.	Weight of Wet Rubber obtained at each operation in ounces.														Total weight of wet rubber.		Weight when dry.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lbs.	oz.	lbs.	oz.
Nov.-Dec., 1898	$\frac{3}{4}$	$1\frac{3}{4}$	$3\frac{1}{4}$	6	9	$6\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{1}{2}$	$8\frac{1}{2}$	6	$6\frac{1}{2}$	10	$8\frac{1}{2}$	8	5	$9\frac{3}{4}$	3	0
April-May, 1899	Daily record mislaid																2	8
Nov.-Dec., 1899	$1\frac{1}{4}$	$2\frac{1}{2}$	3	$6\frac{3}{4}$	8	10	$10\frac{1}{4}$	$6\frac{1}{4}$	9	$11\frac{1}{2}$	$11\frac{1}{2}$	11	8	6	4	3	4	
Oct.-Nov., 1900	0	$\frac{1}{2}$	3	$4\frac{1}{2}$	$6\frac{1}{2}$	9	$9\frac{1}{2}$	$12\frac{3}{4}$	14	14	12	15	12	7	$11\frac{3}{4}$	3	12	
Total ...	$1\frac{3}{4}$	$3\frac{1}{2}$	$8\frac{3}{4}$	$13\frac{1}{2}$	$21\frac{3}{4}$	24	$29\frac{1}{2}$	$26\frac{1}{4}$	$27\frac{1}{2}$	29	32	$33\frac{1}{2}$	$34\frac{1}{2}$	28	19	$9\frac{1}{2}$	12	8

It will be seen by the above that this tree yielded freely after the third operation and continued to do so up to the end of the tapping and that there was no reason to discontinue the tapping on account of falling off in the quantity of latex, the only reason for doing so being that the cuts were by this time from three-quarters to one inch wide, and although they heal rapidly it was not thought wise to make them wider. New bark has completely grown over the cuts of the first three tappings. It would appear that October to December are better months for tapping than April and May, but too much importance should not be attached to an experiment made on a single tree either as regards the yield or best months for tapping. I simply record the facts for what they are worth, but as regards yield it should be considered in conjunction with the result obtained in Perak with a hundred trees, the oldest seventeen years old, and this should I think induce capitalists and the Government to consider whether this tree has as yet received the attention it deserves. In the Consular Report already referred to, it is stated that hundreds of miles have to be traversed to reach the rubber districts in Brazil, and although there are probably fifty million acres of forests at present being worked for rubber it is estimated that for Districts where it is fairly plentiful, the average is only one Hevea tree to every two acres, and the estimated yield one to one and-a-half kilos per annum. In a few roughly calculated tests made here I found half a pint (10 fluid ounces) of latex gave three ounces of dry rubber, and coagulated rubber weighed wet lost about 50 % of its weight in drying.

Gutta Percha.

26. In 1899 it was decided by Government to form plantations of Gutta Percha in Malacca, and in May last I was instructed by His Honour the Acting Governor to take down 500 young trees and plant them in Bukit Bruang Reserve. These are the half of a batch of seedlings raised in Penang. Since then Mr. H. C. HULL in his report on the forests of the Colony has advised that plantations on a large scale should be made both in Penang and Malacca, and by way of a beginning the remaining 500 will be planted in Penang at the proper season. Consequent on this recommendation a good deal of attention has been devoted to this subject during the past few months. None of the trees in Penang have fruited this year nor have we been able to obtain seeds elsewhere. Mr. DERRY, Superintendent of Government Plantations, Perak, wrote me in November that a tree growing in the Resident's grounds at Kuala Kangsar was in fruit, but on a subsequent visit, a month later, he found that squirrels had eaten them all with the exception of two fruits which he sent me for herbarium specimens. These are the only fruits I have seen or heard of this season. All the *Dichopsis* are slow growers and transplant badly, great care will therefore be necessary in preparing plants and laying out plantations. Young plants in the Nursery under most favourable conditions have grown about a foot in height in a year. The tree referred to as fruiting at Kuala Kangsar is said to be eighteen years old and is twenty-five feet high, with a girth of twenty-four inches at three feet from the ground. As it is uncertain when we may be able to obtain seeds in sufficient numbers to plant on a large scale we have been trying recently in various ways to propagate from cuttings. It is too soon yet to say what percentage will grow from cuttings but the prospect of raising a large stock by this means is not encouraging. Some species of *Dichopsis* may grow from cuttings fairly well (though seedlings, of all if obtainable should have the preference) but *D. gutta* or *D. oblongifolia*, whichever the Penang plant may be, and there is some doubt about it, is a most difficult subject. To obtain cuttings and information as to the quantity of gutta to be obtained, &c., we cut down one tree in the Highland Reserve and collected the gutta in the native manner, the result being one and-a-half pounds of first class gutta percha. This tree was 55 feet high with a moderately clean straight stem 39 inches in circumference at five feet from the ground, and at least forty years old. I do not consider this method or the result satisfactory and some other and better way of extracting the gutta will have to be devised. Tapping in the same way as rubber trees is not applicable to this tree and the solution of the problem will probably be some system of cutting the plantations at a comparatively early age, when they will coppice, and treating bark and leaves at a central factory; unless the leaves alone are found to be of sufficient value and produced in sufficient numbers to render plantations remunerative. *Dichopsis gutta* occurs only at low elevations and it is desirable to introduce for planting the upper portions of Penang Hills the species that occur on Perak Hills up to 3,000 feet. This is known locally as "Gutta Taban Putih" and is I believe *D. pustulata*, I have recently had an opportunity of observing this tree on the Taiping

range and found it abundant at 2,000 to 2,500 feet, whereas the Penang tree seldom or never occurs above 1,000 feet.

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 15th January, 1901.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1900.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden ...	4,500 00	<div> Wages ... 3,174 61 Plants and Seeds ... 87 27 Pots and Tubs ... 153 25 Manure and Cartage ... 31 00 Material for Herbarium ... 103 70 Books and Periodicals ... 28 00 Planks for cases and labels ... 147 25 Tools ... 113 10 Material for repairs, &c. ... 343 14 Iron for renewing sheds ... 85 64 Road metal ... 107 00 Miscellaneous Petty Expenses ... 123 48 </div>	
		Balance ...	4,497 44
		Total ...	2 56
			4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow	1,000 00	<div> Wages ... 795 54 Seeds ... 33 67 Tools ... 61 84 Pots ... 22 00 Manure ... 33 09 Material for Repairs, &c. ... 51 70 </div>	
		Balance ...	997 84
		Total ...	2 16
			1,000 00
Government Grant— Maintenance of Experi- mental Nursery ...	200 00	<div> Wages ... 155 30 Manure ... 40 00 </div>	
		Balance ...	195 30
		Total ...	4 70
			200 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance ...	736 00	<div> Salaries and Wages ... 588 00 Travelling Allowances ... 121 73 </div>	
		Balance ...	709 73
		Total ...	26 27
			736 00

APPENDIX A—Concluded.

Revenue and Expenditure of the Botanic Gardens, Department, Penang, 1900.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Travelling and Personal Allowances ...	462 00	{ Pony Allowance ...	225 00
		{ Expenses of trip to Dindings ...	52 75
		{ Expenses of sending Overseer to Lankawi ...	43 54
		{ Expenses of journey to Perak ...	41 76
		{ Expenses while on duty with Mr. H. C. Hill ...	60 75
		{ Miscellaneous ...	3 02
		{ Field and Personal Allowances ...	19 96
Total Government Grants	6,898 00		446 78
Revenue from Plant sales	550 80	Balance ...	15 22
Revenue from Swim- ming Bath }	37 40	Total ...	462 00
Total Collected ...	588 20	Total Expenditure ...	6,847 09

C. CURTIS,

Assistant Superintendent of Forests.

Appendix B.

BOTANIC GARDENS,

Penang 28th, February 1901.

SIR.—In accordance with your instructions, I went to the Dindings on the 15th instant, and inspected the two blocks of Forest it is proposed to add to the Reserves. I also took the opportunity of seeing as much as I could in the time of the already demarcated areas which are practically those I had the honour of suggesting in 1888, and in which no cutting of any importance has been authorized since that time.

2. From the papers you sent me to see I gather that there is an impression that Mr. CANTLEY at some time visited this District and made certain suggestions, but I think this is a mistake. I have no recollection of his having been there subsequent to my joining the service in 1884, and I am pretty sure that he had not previously done so.

3. The present Reserves consist of six blocks, *viz* :—Pangkore Island, Lumut Hills, Tanjong Hantu, Bukit Segari, Gunong Tunggal, and Tanjong Burong. The latter is all mangrove and is reserved specially for fire wood.

4. The two portions that it is now proposed to add are several miles apart, one being in the extreme North of the District, and the other in the extreme South. The District Officer proposes that these should be known as Ulu Bruas, and Tulloh Morah Reserves.

5. Ulu Bruas Reserve is a triangular block of forest land, mainly hilly, but including some low wet jungle, which has been recently worked by timber cutters. The boundaries on two sides are well defined by the territorial boundary line which divides Perak and the Dindings, and the third by a cart-road for a distance of about two-and-a-half miles. A good deal of land has been taken up along the edge of this road for cultivation so that in places the road will not be the actual boundary but a line running more or less parallel with it above the line of cultivation. It is difficult to estimate the area with anything like correctness but it is safe to say that the area is not less than 1,500 acres. This Reserve contains the only Gutta Percha (Gutta Taban) I saw in the District. I actually saw only half-a-dozen trees but I have no doubt there are many more. The largest measured had a girth of 5' 6" at five feet from the ground.

6. Tulloh Morah is an oblong block of well wooded hills, the boundaries of which will follow the base of the range leaving out the flat land suitable for cultivation along the coast line. With the little I was able to see of this, I should not like to make a guess as to the area.

7. As regards your instructions that I should suggest new Reserves, or additions to existing ones, there is some difficulty. There has been no survey and consequently it is impossible to say what proportion of the District is already reserved. One thing is certain and that is that the rough estimate as given in the District Officer's Report for 1898 is a very long way below the mark. Pangkore Island for instance which with the exception of village sites is practically all Forest Reserves, is put down at 1,250 acres. The total area of Pangkore Island which is about 4 miles long cannot be less than 5,000 acres, probably more, and the village sites and cultivated portions do not I should say represent one-fifth of the whole, so that the Reserve must be more like 4,000 acres.

8. There is also another matter to be considered in suggesting any considerable addition and that is the system it is intended to pursue in the future as regards these Reserved Areas. The original idea of prohibiting wood-cutting within the areas known as Forest Reserves was for the purpose of allowing time for them to recover by natural means the effects of severe and indiscriminate cutting in the past, and as soon as that had been accomplished to again open them for working, one or more at a time, in rotation, but without satisfactory maps and an intimate knowledge of the area and contents of each Reserve it is impossible to formulate a working plan or to say when the time will have arrived to put this intention into effect.

9. The whole of the Dindings is practically forest. It appears from the District Officer's Report that the Revenue from Forest produce in 1888 was over \$15,000 and represented 70% of the Revenue of the whole District. The population is not supposed to be increasing and so far as I can see no appreciable increase in cultivation has taken place during the past ten or twelve years. Under these circumstances it is important that the Forest should be managed so as to derive as much Revenue as is consistent with their being maintained in a state of efficiency, which is to say that the quantity cut each year must not on the whole exceed the annual normal increase.

10. If I may venture to offer a suggestion it is this, seeing that the greater portion of the Dindings is forest and that neither population nor agriculture shows any appreciable increase the whole of the Crown Forests, both reserved and unreserved, should be considered from a business point of view and supervised by one Forest Staff, to do this the Forest Guards would have to be increased in number and stationed in different parts of the District, preferably in the immediate vicinity of the principal Reserves. Each guard should be kept informed of all licences issued for his part of the District and it should be his duty to see that the produce removed corresponds with the licence both as regards kind and quantity. It would also be his duty to arrest any person cutting or removing without a licence jungle produce from any Crown Forest whether reserved or not. This would in my opinion be simpler for the Officer in charge, and more economical and effectual than keeping one staff for reserved and another for unreserved forest, and that without in any way rendering the protection of the Reserves less effective than at present. On the contrary, my experience in Penang has been that nine times out of ten it is professional wood-cutters who take out Passes that get into the Reserves and it is most important for the Forest Guards to know who have licences and where they are working.

11. The principal distinction I would draw between reserved and unreserved Forests in this District is that no portion of the former should at any time be granted for agricultural purposes, while the latter is available for that purpose should a demand for land arise. For the present, and probably for some years yet no cutting should be allowed within the Reserves but the time will come when a considerable Revenue should be derived from these Reserves.

12. In one of the papers you sent me to see I noticed that His Honour the Officer Administering the Government considers that one-fifth of the District should be Reserves, and I think that with the two new portions now to be added, the total area will not fall far short of that; but in the absence of any survey it must be more or less guess work.

I have, &c.,

C. CURTIS,

Assistant Superintendent of Forests.

Appendix C.

BOTANIC GARDENS,
Penang, 2nd November, 1900.

SIR,—In accordance with your verbal permission to proceed to Perak for three or four days to obtain more definite information about the range of Gutta Percha trees, &c, on Taiping Hills, and to collect Orchids and other plants of interest for cultivation in the Public Garden here, I left for Taiping at 10 P.M. on the 25th October, and returned at 7 P.M. on the 30th.

2. On arrival in Taiping I proceeded first to the Museum where Mr. L. WRAY, the Curator, kindly allowed me to look through his herbarium specimens of *Sapotaceæ*, in which order are included our most important Gutta Percha producing trees, and gave me much valuable information. He also showed me samples of Gutta from various species, most of which have been collected and prepared by himself, and as the herbarium specimens were collected at the same time and from the same tree these samples are of more than ordinary interest and value.

3. On leaving the Museum I walked up to Maxwell's Hill where Mr. DERRY, Superintendent of Government Plantations, gave me all the information and assistance in his power.

4. During my stay in Perak I saw only two species of *Dichopsis* (Taban) neither of which appear to be *Dichopsis Gutta*, and until flowering and fruiting specimens are obtainable their specific names must remain more or less doubtful. I showed Mr. WRAY leaf specimens on my return from the hill and he thought they corresponded with what the Malays call Taban Chaier and Taban Putih, and which have been determined for him at Kew as *Dichopsis polyantha* and *D. pustulata*. In the absence of flowers or fruit the difference in appearance is not great. At a little distance they look all alike, but those in Perak and Penang, and it is only on examining them closely that one sees there is a difference.

5. The question of the correct botanical name, although most desirable to know is not of so great importance as the question of the quality of the Gutta and the situation in which each particular species is found growing naturally, so that in any planting scheme we may plant the right species and in the right place.

6. On the Taiping Hill, Taban Putih (*D. pustulata*?) extends up to 3,000 feet and is most abundant at 2,000-2,500 feet. I collected a small sample of gutta and it is so far as I can judge of good quality. Mr. WRAY who knows the tree well informs me that it is always considered very good gutta, but not so good as *Dichopsis Gutta* (Taban merah).

7. *Dichopsis gutta* occurs only at low elevations. Much of the available and uncultivated land in Penang that it is desirable to re-afforest, such, as areas within the Reserves and abandoned spice gardens, are at an elevation of from 1,000-2,000 feet and it therefore seems probable that this Perak mountain form *D. pustulata*? will prove more suitable for planting in places in Penang than *D. gutta*.

8. *Dichopsis polyantha*? (Taban Chaier) grows at a much lower elevation than *D. pustulata*? (T. Putih) and is found quite down to the foot of the hill, but as *Dichopsis Gutta* also grows at low elevations and is the more valuable of the two, this will probably be of less importance as a tree for planting unless it should prove that it is the quicker grower or yields a greater quantity of gutta which might compensate for the difference in price. On these and many other points more definite information than is at present available is wanted.

9. Of Orchids, Palms, and other plants for cultivation in the garden, I collected great numbers.

I have, &c.,

C. CURTIS,
Assistant Superintendent of Forests.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

FOR THE YEAR

1901

BY

W. FOX, Esq.,

Acting Director.



PUBLISHED BY AUTHORITY

SINGAPORE :

PRINTED AT THE GOVERNMENT PRINTING OFFICE.

1902

Annual Report on the Botanic Gardens, Singapore, for the year 1901.

The Weather.

The year 1901 was very dry since only 78.36 of rain fell in the Gardens. March had the smallest fall 3.93, and June the greatest 9.67. The effect on the vegetation was not very marked, although it is usual for a dry year to be a heavy seed bearing year.

Staff.

The Director went on long leave on March the 17th, on which date I took over charge of the Department. There were several changes in the staff owing to the dismissal of ZAIN ABDUL RASIP, the Chief Mandor of the Economic Garden, for carrying on an illicit sale of Para Rubber seeds. This man had for twelve years borne an excellent character, and had also acquired a considerable knowledge of Economic plants and their uses, and the loss of his services to the Department, at a time when it was undermanned, was felt acutely. His place was filled by MOHAMED HANIF, the Mandor from the Upper Gardens, who in turn was replaced by an entirely new, and of course untrained, man from outside. This fact emphasizes the long felt need of apprentices who could fill the places of trained men who leave the service. In connection with the subordinate staff, I am glad to record the sanction by Government of a Scheme for the improvement of their positions, which will result, I hope, in making them as a body contented, and promote the interests of themselves and the Department.

2. The coolies have on the whole worked fairly well, but, as reported last year, the class of labour is not what it used to be; the fact is that the coolies, as soon as they have picked up a smattering of Malay and the rudiments of their work, leave the Gardens for private employment or to labour on Public Works, with the result that the work of the Gardens has to be carried on with quite untrained men. There has been an unusual number of Beri-beri cases amongst them, no less than 29 cases having occurred, generally of a mild character. Three cases were however fatal. In May the number of cases were so numerous, and in one or two cases so serious, that I reported the matter to the Principal Civil Medical Officer who had the Coolie Lines disinfected, and gave general instructions as to treatment.

Visitors.

3. The number of Visitors was about the same as in the previous year, when the number was abnormal owing to the many Mail passengers who visited the Gardens. Several eminent men of science, chiefly Germans and Americans, also visited the Gardens, in several cases staying for some months studying questions of Economic Botany.

4. The Regimental Bands played in the Gardens from time to time, attracting enormous crowds of people, especially on the occasion when the massed bands of the 3rd, 13th, and 16th Regiments of Madras Infantry gave a performance in November.

5. It will be a question in the near future whether the Gardens, or at least that portion round the Band-Stand, are not too small to accommodate such large numbers of people.

Aviaries.

6. The aviaries and animal enclosures have for some time required overhauling; the latter are, I regret to say, practically beyond repair. In the early part of the year the Public Works Department prepared a series of plans of enclosures for the better accommodation of the animals. The buildings thus designed would have placed the Zoological Department in a very efficient state, but the scheme was thrown out by the Legislative Council, and Government gave orders for the disposal of all the larger animals.

7. The following additions were made to the collection during the year:—Two Wa-Was (*Hylobates lar*.) presented by Miss Edith Abrams, one Javanese squirrel

(*Sciurus bicolor*.) presented by Mr. F. W. Christian, three Pythons (*Python reticulatus*) presented by Messrs. Romenij, Branagan, and F. Teng Quee respectively, one flying fox with young, presented by Mr. Lim Koon Yang; one Binturong (*Arctictis binturong*) presented by D. H. Wise, Esq., one Christmas Island Pigeon (*Carpophaga Whartoni*) presented by M. Hellier, Esq., one young red Civet cat and one long tailed monkey, presented by R. Shelford, Esq., Sarawak, two storks presented by Madame Gorski, and two young monkeys and three parrots from the Andamans. One young Berok (*Macacus nemestrinus*) was born in the Gardens. A female Rhinoceros procured by the Austrian Consul was deposited in the Gardens; it is intended for the Zoological Gardens at Vienna and will be shipped there in the coming spring. A female specimen of the rare "Sapi-Utan" (*Anoa depressicornis*) was obtained from Celebes by the Museum authorities.

8. The following animals died during the year. One (*Python curtus*), one Eagle, three Phalangers, two Kijangs, one wild cat, three Christmas Island Pigeons one deer, and one black swan.

Upkeep and Buildings.

9. The chief work under this head has been the erection of a new plant house near the potting shed. It consists of seven long tables of coral 48 feet long. It has a ridge and furrow roof, covered with Bertam chicks obtained in Penang, and supported by steel rafters on brick pillars; it is a most substantial, structure and will last for years. It has been filled with a miscellaneous assortment of plants, chief of which are a named collection of our various palms, some of the rare ferns, and some of the most recent introductions from Kew. All the plants have thriven well in it. The roof of the small nepenthes house has been entirely renewed, as also a very large part of the Aroid and Begonia house. The work of keeping up of the beds, borders and shrubberies has perhaps taken up a greater amount of time than usual, as a special effort was made to render the gardens more bright and attractive with flowering plants.

10. The drives and paths have been repaired where necessary. Of the former, the drive from the main entrance to the deer enclosure was entirely remetalled during the year.

11. The bamboo hedge surrounding the western part of the gardens and that from the office to the main entrance, are not in a very creditable state, owing partly to their being under trees, and the soil being poor, but also to the constant breaking through by syces, native soldiers, etc. I should be glad to see the hedge replaced by a low wall surmounted by an iron railing similar to that in front of the Lunatic Asylum.

Plants and Seeds. (Exchanges)

12. Exclusive of the large consignments of plants and seeds (chiefly guttas and Rubbers) and the monthly supply of seeds from Messrs. Carter & Co., we have received during the year one hundred and sixty plants and one hundred and eight bags or packages of seeds. The following is a list of contributors:—

The Royal Gardens, Kew. The Botanic Gardens, Buitenzorg, Calcutta, British Guiana, Saigon, Saharanpur, Madagascar. Messrs. Rauch, Von Pustau, Arden, and Schlechter. The Government Horticultural Gardens, Nagpur. The Tokio Plant and Seed Co. The Agri-Horticultural Society of India. Messrs. Herb & Wulle, Naples.

13. Seven hundred and sixty-nine plants and eight hundred and four packages of seeds were sent to forty-two Institutions and individuals.

14. Amongst the most useful plants introduced during the year were the true West African Rubber (*Funtumia elastica*), about 100 plants of which were raised from seed supplied by Mr. S. ARDEN, and some thousands of Gutta Sundik (*Payena Leerii*) supplied from Buitenzorg. From Kew came several species of *Landolphia* (the African Rubber plant) including two new species, *Garcinia Kola*, from old Calabar, and *Mimusops Schimperii* (the *Persea* of ancient writers), from Madagascar. From the same establishment came a collection of miscellaneous plants of striking interest chiefly selected by the Director Mr. H. N. RIDLEY. The Rt. Rev. Bishop HOSE kindly presented a set of 25 varieties of hybrid *Rhododendrons* which he obtained at Kew.

Plants in Flower.

15. Most of the plants mentioned in former Reports have flowered during the year and the following for the first time. *Kigelia pinnata* (T. Africa) *Exostemma cariboeum* (W. Indies) *Brunfelsia nitida* (T. America) *Bulbophyllum grandiflorum* (New Guinea.)

Library.

16. The following books and periodicals were added during the year.

Hunger Dr. F. W. T. Een Bacterie-Ziekte Der Tomaat.

Ziekten en Beschadigingen van het blad by Deli-Tabak.

Lloyd C. G.—Mycological notes.

Wood Medley, J.—Natal Plants.

Kramers, Dr.—Mededeelingen over Koffie.

Maiden, J. H.—Tracts on the useful Australian Plants.

Zimmermann, Prof. Dr. A.—Over het enten van Koffie.

Dyer-Thiselton, Sir W. T.—Flora of Tropical Africa.

Tryon Henry, Tracts on Entomology and Pathology of Queensland Plants.

Koningsberg, Dr. J. C.—De Vogels van Java en Hunne Oeconomische Beteekenis.

Cook, O. F.—The Origin and Distribution of the Cocoa Palm, The Chayote (A Tropical vegetable.)

King Sir Geo.—Materials for a Flora of the Malay Peninsula Nos. 11 and 12.

Cooke, Theodore, Flora of the Presidency of Bombay.

Masters Dr. Maxwell T.—Hybrid Conifers.

Smith, C. B.—A German Common School with a Garden.

Rusby, Dr. H. H.—A Comparison of the English and German works on the Genera of Plants.

Ward, Dr. L. F.—Description of the species of Cycadioidea.

Kooders, S. H. and Valetton Dr. Th.—Boomsoorten op Java.

Schrenk, Von H.—Some Diseases of New England Conifers.

Dorsett, P. H.—Spot Disease of the Violet.

Pierce, N. B.—Peach Leaf Curl, Its Nature and Treatment.

Bentham, George.—Flora Hongkongensis (Purchased.)

Wilcox, Dr. E. M.—Glimpses of Tropical Agriculture.

Schmidt, Johs.—Flora of Koh Chang.

Gifford, John.—Silvicultural Prospects of the Island of Cuba.

Hitchcock, H.—Distribution of the Agricultural Exports of the U. S. 1894-98.

„ Our Trade with Japan, China and Hongkong, 1889-99.

„ Sources of the Agricultural Imports of the U. S. 1894-98.

„ Foreign Markets for American Agricultural Products.

„ Our Foreign Trade in Agricultural Products 1891-1900.

Coulter, J. M. and Rose J. N.—Monograph of the North American Umbelliferae.

Palmer, T. S. and Olds H. W.—Laws Regulating the Transportation and Sale of Game.

Engler, A.—Pflanzenreich 6 parts. (Purchased)

Christ, Dr. H.—Ferns of Shen-Si and Costa Rica.

De Bie, H. C. B.—De Landbouw Der Inlandsche Bevolking op Java.

Smith, E. F.—Wakker's Hyacinth Germ.

Gildemeister and Hoffmann.—The Volatile Oils. (Purchased)

Gordemoy, Dr. J. de.—Gommes Resines D'origine Exotique et vegetaux qui le Produisent.

Rydberg Axel Per.—Flora of Montana.

„ New Species from westers United States.

„ Delphinium Carolinianum and Related species.

„ Studies on the Rocky Mountain.

Dougal, Mac T.—Symbiosis and Saprophytism.

Nash, V. George.—The Dichotomous Panicums (some new species.)

Small, J. K.—Notes and Descriptions of North American Plants.

Blodgett, F. H.—Vegetative Reproduction and Multiplication in Erythronium.

Williams, R. S.—Two New species of Grimmia from Montana.

Britton Elizabeth, G.—Life History of Schizaea Pusilla.

James Veitch and Sons.—Manual of Coniferae (Purchased)

Hallier, Dr. H.—Indonesische Acanthaceen.

Dabney, C. W. Jr. Ph. D.—The Cotton Plant.

Brannt W. T.—India Rubber, Gutta-Percha and Balata (Purchased)

Clark, C. B.—Commelynaceae.

Henriques, Dr. R.—Kautschuk.

Warburg, Dr. O.—Kautschukpflanzen.

Loew Oscar.—A New Enzym of General Occurrence.

Hissink, Dr. D. J.—Toelichting Behoorende bij de Grondsoortenkaart.

Weinland, Dr. C. A. F.—*Reliquiae Weinlandianae*.

Preyer, Dr. Alex.—*Über Kakaofermentation*.

Chesnut, V. K. and Wilcox, E. V.—*The Stock-Poisoning Plants of Montana*.

Nanninga, Dr. A. W.—*Veranderingen Welke Deze Stoffen*.

Lefroy Maxwell.—*General Trëatment of Insect Pests*

Urban, Prof. Dr. Ing.—*Vorgeschichte des Neuen Könige Botanischen Gartens, Berlin*.

Prudhomme, M. *L'Agriculture sur la Côte est de Madagascar*.

17. Exchanges:—

Bulletins of.—Kew, Jamaica, Trinidad, The West Indies, Ceylon, Buitenzorg, Indo China, Land Record and Agriculture, N.W.P. and Oudh, Madagascar, Koloniaal Museum te Haarlem, New York, L' Herbar Boissier, Wisconsin (U. S. A.)

Journals.—Journal of the Board of Agriculture, Experimental Station Records (America) Annales du Jardin Botanique, Annals of Royal Botanic Gardens Calcutta, Journal of Agriculture for Zanzibar, Planting Opinion Madras, Notizblatt Berlin, Queensland Agricultural, Dept: of Agriculture Western Australia, The Chemist and Druggist, Acti Horti Petropolitani, The Annual Report and Proceedings of the Agri-Horticultural Society of Madras, Agricultural Journal of the Cape of Good Hope, Tropenpflanzer (Berlin) Revue des Culture Coloniales (Paris) Journal D' Agriculture Tropical (Paris). Bulletin of the Dept: Journal of Land Record and Agricluture Madras, The Agriculatural Ledgers of India, Bulletin Du Jardin Colonial (Paris) North American Fauna, Indian Museum Notes, Pharmaceutical Review (America) Bulletin of the Ohio Agricultural and Experiment Station (U. S. A.)

18. Purchased:—

Indian Gardening and Planting, Gardeners Chronicle, Journal of the Linnean Society, The Botanical Magazine, The Tropical Agriculturist, Dictionnaire Iconographique des Orchidees.

19. Annual Reports:—The Forest Dept: of South Australia; Land and Agricultural Dept: Madras, Dept: of Agriculture Queensland, Merck's Annual Report and Digest, Botanic Gardens:—Natal, Ceylon, Trinidad, Hongkong, British Honduras, Culcutta, Buitenzorg, New South Wales, Travancore, Barbados, Mysore, British Guiana, Gold Coast, Forest Dept: Madras, Zoological Garden, Ghizeh (Cairo), Queensland Acclimatization Society, Agricultural and Mechanical College, Still-water, Oklahoma (U. S. A.) Smithsonian Institution, The Year Book of Dept: of Agriculture, Washington, U.S.A.

Herbarium and Office.

20. Two hundred and sixty-nine herbarium specimens of Malayan Plants were received from Sir GEORGE KING. Seventy-one species from Dr. PRAIN, Calcutta, and 32 species of plants collected by Mr. CURTIS in Indragiri were received and mounted. One hundred and four species of plants and forty-four wood specimens were sent to the Royal Gardens, Kew; three hundred species of plants and one bundle of Palm leaf specimens were sent to the Kolonial Wirtschaftliches Komitee, Berlin.

A collection of Malayan fruits was sent to the Director, Botanic Gardens, New York.

One packet of Gutta specimens was taken by Dr. SHERMAN of the Forest Bureau, Manila. The herbarium specimens of the following Natural Orders were sent to Kew for critical comparison by Mr. H. N. RIDLEY, the Director; *Viz*:—

Palmae.

Aroideae.

Agricultural Bulletin.

21. For some time past a want has been felt by the Planters and others of having some kind of a periodical which would serve as a medium for the record and exchange of their experiences and also contain articles on agricultural and allied subjects appertaining to their interests. This want has been met by the publication of the existing Bulletin in a somewhat different form, and by its issue regularly once a month.

Some three numbers were issued up to the close of the year, and although it is somewhat early to criticise it in its infancy, I may be allowed to say that I can see very clearly that the Editor will have either to go about the Peninsula himself, and see what is going on, or else he will have to have some one with sufficient knowledge to do this for him, for it is obviously impossible for the Editor to write about subjects which require examination on the spot, when he is kept constantly in Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1902.

RECEIPTS.		EXPENDITURE.	
	\$ c.	Salaries.	\$ c.
By Balance in Bank ...	3,024 26	Salaries	5,880.40
„ Government Grant ..	9,150 00	Bills	6,298.96
„ Sale of Plants, Seeds and Flowers ...	2,763 c9	Balance in Bank	2,796.51
„ Interest ...	38 52		
	\$14,975 87		14,975.87

Inspection of Coco-nut Trees.

22. The good effect accruing from constant inspection of coco-nut estates, tanneries and saw mills, is shewn by the fact that a Palm beetle is now very rarely seen, while very few years ago the beetles and their larvæ could be seen by the thousand. During the year notices were served on 253 persons calling on them to destroy old coco-nut stumps, piles of rubbish, etc., and in every case were readily complied with, so that there was not a single prosecution. In all there were destroyed 835 old trees, 121 stumps and 32 piles of rubbish.

Vote	...	...	\$486.00
Expenditure	...	...	\$441.12

Economic Gardens.

23. The ground opened up in 1900 for planting the Central American Rubber (*Castilloa elastica*) was planted early in the year. The growth of the plants has been somewhat irregular, owing probably to some parts being wetter than others; unlike Para Rubber, these plants do not seem to like low damp ground, as those on the drier parts have made the best growth.

24. Para Rubber.—Our trees are still the principal stock plants for the supply of seed, the demand for which was about the same as last year. I anticipate however in the near future a much smaller demand, as many of the oldest trees on Mr. BAILEY'S Estate have begun to fruit. It is satisfactory to record that the Chinese squatters are turning their attention to this cultivation. One hundred and fifty-two thousand seeds, and nine thousand nine hundred and seventy-five plants were distributed as shewn in the subjoined table, which gives the quantity distributed during the past six years:—

	1896.	1897.	1898.	1899.	1900.	1901.
Colony ...	2,810	2,885	1,800	77,481	52,750	74,025
Perak ...	Nil.	Nil.	Nil.	7,271	Nil.	Nil.
Selangor ...	Nil.	20,625	76,700	71,507	79,350	66,950
Pahang ...	Nil.	3,650	3,550	1,400	...	...
Negri Sembilan ...	Nil.	...	600	...	...	...
Johore ...	Nil.	600	21,300	3,650	17,500	11,200
Borneo etc ...	Nil.	4,150	5,500	1,273	2,400	...
	2,810	31,910	109,450	162,582	152,000	152,175

25. The usual stock of young Economic plants was maintained by propagation from seed and cuttings. Blanks were filled up in the arboretum, and in the section plots. With the exception of one demand for 1,200 plants for Cochin China not a single enquiry was made for Ramie.

Vote for Up-keep of Economic Gardens ... \$2,200.00

Expenditure.

Salaries of Mandore and Coolies	...	...	\$1,911.36
Tools	...	...	204.40
Timber, bricks, lime etc.	...	...	82.33
Balance	...	...	1.91
			<hr/> \$2,200.00 <hr/>

Gutta-Percha.

26. More attention has been given to this subject than to any other during the year, and, for the first time in the history of the Colony, seeds of the true *Dichopsis gutta* were gathered, although for upwards of 15 years efforts have been made to obtain them both by ourselves and by the late Sultan of Johore. To Singapore belongs the honour of getting the first seeds from a tree in the Gardens which is the direct descendant of the original trees at Bukit Timah which gave the first Gutta-Percha brought to the notice of Science, and on which the genus (*Dichopsis*) was founded. The Penang trees also furnished several thousand seeds, at nearly the same time. Interesting as this success is, we should have made comparatively little progress had we been dependent on seeds alone. I am glad to say, however, that some forty-one thousand saplings have been obtained, and either planted out directly in their permanent positions, or put in nursery beds for future planting. It must, of course, be expected that a considerable number of these will succumb, but putting the failures at 50 per cent., which I believe will prove an over-estimate, I think we may be satisfied that a distinct advance has been made. Of the 41,660, 16,000 were sent to Penang; a little over 10,000 to Malacca; and the balance 16,007 have been kept for stocking Bukit Timah. I am glad to record that Mr. BURN-MURDOCH, the Chief Forest Officer, who inspected the work at Bukit Timah, expressed his approval of what had been done. As regards the exact determination of the different species much has been done, although it is admittedly a difficult genus to determine. The Director in last year's report discussed the probability that *Dichopsis gutta* and *D. oblongifolium* are one species, the leaf variation being more or less identical in both types. There is however no doubt on this point, that *D. oblongifolium* is the species that has yielded the chief supply of gutta Taban for many years, and although there is a great amount of leaf variation in that species the practised eye can easily recognize it from other species such as *D. borneensis*, *D. pustulata*, *D. Treubii*, and others. The critical studies of Messrs. SCHLECHTER and SHERMAN, who spent some months studying this genus both here and in Java and Borneo, have been of much assistance to us. Their conclusions, which are in accordance with ours, are, that the two best sorts to cultivate are *D. oblongifolium* and *D. borneensis*, and of the two the former is preferable as it grows more readily, and is indigenous here.

Planting in Forest Reserves.

27. The Mandor in charge at Bukit Timah suffered severely from fever, as also did his wife and family, so that they were obliged to leave the new quarters erected in May. The quarters in question are placed on an apparently healthy site close to the road leading to the top of the Hill. I attribute the fever to the disturbance of the soil during the erection of the building, and believe that the place will gradually become healthier. The coolies who live in lines immediately behind the Mandor's quarters also suffered from fever, but not to the same extent as the Mandor. The only work done with regard to the trees planted in previous years was clearing the ground round them, so that the coolies were chiefly employed in preparing ground for and planting out gutta percha saplings.

Vote.

Planting in Forest Reserves	...	...	\$ 300 00
Expenses of Planting Gutta-Percha and Para Rubber			
(according to the Printed Estimates)	...	...	300 00
Further extended on two occasions	...	...	4,000 00
			<hr/> \$ 4,600 00 <hr/>

Expenditure.

Expended on Procuring Gutta-Percha Plants	...	\$ 2,307 40
Coolies Wages	...	679 57
House Rent for Mandor and Cartage on Plants	...	17 00
Tools	...	26 20
Balance	...	1,569 83
		<hr/> \$4,600 00

Government House Grounds and Domain.

28. A new Mandor, TAJURDIN, was appointed on the first of June, after receiving several months training in the Botanic Gardens. He relieved MOHAMED HANIF who returned to his own post as Mandor of the Botanic Gardens. The new Mandor has worked well and the coolies satisfactorily, and the grounds have been kept in good order. The plant sheds have been repaired where necessary and the staging renewed.

Vote \$2,360.00

Expenditure.

Salary of Mandor and Coolies	...	\$2,030.61
Tools and Stores	...	194.65
Repairs to Plant Shed	...	123.70
Balance	...	11.04
		<hr/> \$2,360.00

Visit of Their Royal Highnesses The Duke and Duchess of Cornwall and York.

In April Singapore was honoured by a visit of Their Royal Highnesses The Duke and Duchess of York, who arrived on the morning of 21st of April and left on the evening of the 23rd. During their stay the weather was intensely hot, and the many plants used in the decorations suffered a great deal, notwithstanding our efforts to keep them watered. In all some thousands of plants were used and some tons of greenery, chiefly (Ribu-Ribu) "Lygodium scandens," and (Rumput-halus) "Lycopodium cernuum." H. R. H. The Duchess was graciously pleased to accept for the Royal Yacht a small collection of 36 plants.

W. FOX,

Acting Director of Gardens, Singapore.

Botanic Gardens, Penang.

The only change in the staff of this Department was the appointment of Sergeant WELLS to take charge of the grounds of the Governor's Hill Bungalow in succession to Mr. O. KEEFFE, who was appointed Light-Keeper at Muka Head. Sergeant WELLS assumed charge on his return from leave in May.

Waterfall Garden.

2. The maintenance of the Waterfall Botanic Garden in an efficient and attractive condition occupies the greater portion of the time of the officer in charge in this Settlement, but although the Forests are now, and have been for some years, under the supervision of the Collector of Land Revenue and District Officers, a good deal of the work in connection therewith devolves on the Assistant Superintendent of Gardens also. This has been specially the case during the past year in connection with starting plantations of gutta percha trees in Penang and Malacca, and necessitated my absence from Penang for a period of about six weeks, besides the time occupied in the Island in connection with the same subject.

3. So far as funds admit efficiency has been maintained, and some improvement effected, but the purchasing power of the dollar, both as regards labour and material has so greatly diminished since the time when the annual amount of the Government Grant was fixed at \$4,500, that efforts in the latter direction are limited, and it became absolutely necessary to ask for an increase in 1902, which I am pleased to find has been granted.

4. There being no Museum or other object of special interest in the town, the one place in Penang to which passing visitors resort is the Waterfall Garden. The majority remain here only for a few hours and have not time to go up the hill, which is about the only other point of interest, and it is therefore desirable that this garden should be made attractive as well as useful.

5. The most noticeable addition during the year is a new iron plant shed close to the entrance gate. The material for this has been accumulated bit by bit during the past three or four years, and now put together without the aid of skilled labour or any additional grant of money.

With the exception of new "Chicks" for the roof, about every two years, this shed will not involve any expense in repairs for many years. It is filled with a choice selection of ornamental foliage and flowering plants, mostly large specimens. There is a water tank in the centre for the cultivation of small aquatic plants.

6. The large iron plant shed has been re-covered with chicks as has also the Orchid House, and a portion of the Fernery. A new hand-rail has been fixed to one of the bridges at the top of the garden, the approach to this bridge improved, and sundry repairs to roads, &c. effected.

7. Some new beds have been formed, many of the old ones replanted, and numerous new trees and shrubs added to the collection. Twenty *Kickxia elastica* and one hundred *Palaquium gutta* plants have been planted in and near the Garden in order that visitors may be able to see these plants without making a long journey to the more extensive plantation at Batu Feringgi, which is some miles distant.

8. The show of flowering plants, especially Annuals and Orchids, has been kept going fairly well during the greater part of the year, and the two leading features of the Orchids have been *Habenaria carnea* and *Calanthes*, of which great numbers are grown. At one time there were upwards of two hundred plants of *Calanthe vestita* in flower, and *Calanthe veratrifolia* is seldom out of flower. *Calanthe rubens* from Langkawi comes in later and is now in flower. Although not so showy as *vestita* it is a charming little species. *Saccolabiums* and *Aerides*, planted on the rain trees on either side of the entrance drive, flowered profusely in May owing to these trees having cast their leaves during the long spell of drought, conditions not always attainable here. *Gardenias* too were a sheet of white during the month of May.

9. Drawings of many new and interesting plants which flowered in the Garden were made during the year, and a bundle of over a hundred, done in previous years, was sent to the Royal Gardens Kew for inspection. Many of these were copied before being returned.

10. Considerable additions of Penang plants have been made to the herbarium, and much more might have been done had I not been absent in Malacca and Johore, on-duty in connection with gutta percha, during a portion of the best flowering season for forest trees that we have had for years. There is however some compensation in the collections made in these two places, and during a trip to Indragiri in Sumatra during the early part of the year.

11. Many strangers interested in Botany or other branches of Natural History have called during the year. Two of these, Mr. SCHLECHTER on behalf of the German Government, and Dr. SHERMAN on account of the American, were specially intent on studying both the natural and cultivated vegetable products of this region with a view to introducing any new plant of commercial value, the one to German New Guinea, and the other to the Phillipines; more especially gutta percha producing trees.

12. Plants and seeds have been exchanged to about the same extent and with practically the same Public Gardens, Nurserymen, and private individuals as last year, and plants sold locally to the value of \$585.50, being a slight increase on 1900.

13. More room for herbarium specimens, and a more extensive library are two things much needed in connection with this Garden.

Government Hill Bungalow Gardens.

14. Beyond keeping the grounds in a neat and presentable condition, and maintaining a small but regular supply of vegetables all the year round, nothing is attempted in this Garden. Sufficient pot plants are grown to decorate the corridor and rooms when the Bungalow is occupied, and this is about all that can be done under existing circumstances. Water and manure, the two essentials to high class gardening, are neither of them available in the same manner as in the Waterfall Garden. During the long drought of last year there was barely enough water for domestic purposes, and that had to be carried such a long distance that it would require a small army of coolies to keep a large collection of pot plants going. A cart load of manure costing sixty cents at the foot of the hill costs more than ten times that amount at the Garden. The climate however is, apart from the heavy rainfall during certain months, such that, with an adequate supply of water and manure, many plants that simply live down below luxuriate here. When the hill railway is constructed and pumping machinery for supplying the whole of the Bungalows is complete this can be made the most attractive spot in the whole Colony.

Experimental Nursery.

15. It was decided in 1900 that this Nursery should be abandoned, it having been proved that the altitude is not sufficient for the cultivation of European fruits, and the sum of \$300 was inserted in the Estimates for reafforesting the site. A good number of plants and seeds of the better class native timber trees, and some introduced ones have been planted, but I have not deemed it necessary to spend all this money, as, with a little assistance, this spot, surrounded as it is with large seed bearing trees, is bound to recover itself in a natural manner.

Coco-nuts.

16. The cultivation of Coco-nuts is one of the most important and profitable industries in this part of the world, and one in which perhaps a greater number of individuals are interested than in any other. A few Europeans in this Settlement own large plantations, and in the Native Malay States some have planted on a considerable scale, but on the whole it must be looked on mainly as a native proprietor's crop, and in their interest it is important that the destructive beetles be kept in check. When I first came to Penang \$10-12 was about the price per 1,000 nuts and this was then considered a paying price. In recent years the price has ranged from \$25-30 with a ready market for any quantity. A large proportion of the Penang and Province Wellesley crop is shipped to Rangoon, where the product is used as food in the form of curries, sweetmeats, etc. Both in England and Germany Coco-nut butter is being manufactured on an extensive scale, but the low temperature at which it becomes liquid militates against its introduction here.

The Inspector of Coco-nut trees has been employed seven months in Province Wellesley and five months in Penang in inspecting plantations, Cow sheds, Stables and other places containing material forming suitable breeding places for the Coco-nut Beetle. The number of Notices served, trees destroyed and prosecutions under the Ordinance are shewn below:—

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summons issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District	560	1,864	71	26	408	12	\$ 22 00	9 cases not yet come on for hearing.
Province Wellesley, Central District	164	740	61	7	181	Nil		
Province Wellesley, Southern District,	77	201	42	28	77	Nil		
Penang Island.	411	2,444	283	23	511	19	51 00	
Total.	1,212	5,249	457	84	1,177	31	73 00	

Weather.

17. During the latter part of 1900, and the first three months of 1901, Penang experienced a period of unprecedented drought. During that time little garden work could be done beyond watering, and in spite of every care in this matter quite large trees and shrubs suffered severely. So prolonged was the drought that there was great danger of a water famine in the town, and auxiliary sources of supply had to be hurriedly extemporised in order to avert a calamity. At the time it was proposed by the Municipal Engineer to acquire the Waterfall Valley for the purpose of forming a reservoir in order to obviate the possibility of a similar occurrence. This would of course completely destroy the present Garden on which so much time and money has been spent, and would be a great misfortune, but should it become absolutely necessary in the future to carry out this scheme a new site in the direction of Ayer Etam near the starting point of the proposed Hill Railway would be the most suitable place for the formation of a new Garden.

Agricultural Show.

18. On the 10th and 11th of July an Agricultural Show was held in the Dato Kramat Gardens. As regards the site selected and the attendance on both days it proved a decided success, but the improvement in the quality of exhibits in any Division did not in my opinion show the advance that one naturally would expect in a progressive Settlement. The Horticultural Division was decidedly weaker than on the previous occasion when a similar exhibition took place on the Race Course. That the season had been an unfavourable one there is no denying, a long period of drought being followed by torrential rain, but still the result should have been better. The exhibits of Produce, under which heading were included all vegetable products except Fruits, Flowers, and Vegetables, although containing some new and promising exhibits in the form of Guttas and Rubbers, tending to show the new direction agriculture has taken since the last exhibition, was on the whole not what might be expected. Probably too long a time had elapsed since a Show of this kind was held here, and more interest would be taken in producing high class samples if it were certain that similar exhibitions would be held biennially or triennially. An annual Show on the same scale is more I think than the voluntary financial resources of the Settlement would stand. During the progress of the Show, advantage was taken of the presence of a Para Rubber tree growing in the Show ground to give a demonstration of the method of tapping and coagulating in the presence of several planters interested in the cultivation of this tree.

Gutta Percha.

19. As already mentioned in Paragraph 2, much attention has been paid to the question of gutta percha, especially as regards the means of obtaining a large supply of seeds or plants of the best type, and the best manner of forming plantations, of which a commencement was made under my supervision in Malacca in 1900, and has this year been commenced in Penang. Since then a new Chief Forest Officer from Burmah has been appointed to the Malay States and the Colony, and it is gratifying to learn from a private letter received from him that he approved of the work that has already been done. In January last, I made a trip to Indragiri (Sumatra) in the Dutch Residency of Rio, in order to see the method of planting and propagating gutta percha trees as practised by a gentleman residing there, and if possible to arrange for a supply of seeds or plants. On my return a report was furnished for the information of His Honour the Officer Administering the Government, who took a keen interest in the subject, a copy of which I annex (Appendix B.) Some time later I was deputed, in accordance with an arrangement made with His Highness The Sultan of Johore that a responsible Officer should be sent to see that no material damage was done to his forests, to proceed to Muar to collect and transport to Malacca young gutta percha trees from that region. Every possible assistance was given me by the Johore authorities, who sent me a Steam Launch when I was ready to return, so that in a few days 1,750 plants were landed in Malacca in excellent condition. Mr. HUDSON, who has been appointed Superintendent of Forests and Plantations, Malacca, had by this time arrived and took charge of the planting. In Penang we have been fortunate in getting a crop of seeds from some trees growing in the Waterfall Valley from which over 3,000 plants have been raised. In order to prevent these seeds being eaten by squirrels and monkeys it was necessary to fell all the adjoining trees from which they could gain access to them and to fix an arrangement of bamboo spikes round the boles of the trees themselves. Bats, however, which are equally fond of the sweet pulp in which these seeds are embedded, were not so easy to circumvent and carried off great numbers. Netting some of the best branches in the manner in which bush fruits are protected in England was resorted to, but the effectual protection of large forest trees by this means is next to impossible. These trees flowered during February and March, and ripened their seeds in June and July. Two of them, growing side by side, I have known for years, and until they fruited never for a moment suspected that they were different species, having been accustomed to consider them both *Palaquium gutta*. There is however a difference in the fruit, one being much rounder and of a deeper colour than the other. Good specimens of both flowers and fruits, together with drawings, were sent to Kew and Buitenzorg, and I am not sure that the matter is even now quite satisfactorily cleared up. The Kew authorities consider one to be the true *Palaquium gutta*, and the other an unnamed species which it is proposed to name *Palaquium Curtisii*. Dr. TREUB, however, hesitates as to the exact specific name and points out the great difficulty there is in this genus of determining what is to be called species and how far variation may go and his remarks on this are quite in accordance with my own field observations. He was also kind enough to have an analysis made of samples of gutta from both these trees, the result of which is more

important than the exact determination of the species, and that is that both yield a gutta of first rate quality. The samples were sent marked A. and B. and the result as determined at the Laboratory of Agricultural Chemistry, Buitenzorg, is as follows:—

A.		B.
Water 9.3	...	9.6
Resin 11.8	...	11.9
Gutta 77.2	...	78.7
Dirt 1.2	...	traces

Relation between resin and gutta 1 to 6.6.

In undertaking plantations of such slow growing trees as Palaquium, it is important that only the very best kinds should be planted, as it will require at least forty years to grow a tree large enough to yield one and-a-half to two pounds of gutta percha according to the present method of extraction, but I feel sure that some better system will be discovered by which much more will be obtained than is done at present. Last year I recorded the yield obtained from a tree, 55 feet high and 39 inches in circumference at five feet from the ground, as one and-a-half pounds. This year there has been an opportunity of testing a tree 52 feet high and 42 inches in circumference that was blown down in the Forest Reserve, and the result is one and one-third pounds of clean gutta. So little is known of the actual yields of gutta percha trees that this is of some interest. Several thousand young saplings, showing considerable leaf variation, have been received from the Acting Director, but what proportion of these will survive for eventual planting it is too soon to say. Most of these are in nursery beds where they will remain until the spring of 1903.

Para Rubber.

20. Para Rubber is a subject in which a great number of Europeans, and some natives, are interested. It bids fair to become the great agricultural industry of the Malay Native States, and in this Settlement, in Province Wellesley, three Europeans are planting on a considerable scale. The rate of growth is eminently satisfactory in almost every place this tree has been planted, and as none of the large plantations are yet of an age to commence tapping, the quality and continuance of the yield that may be expected is of more interest to planters than the question of soil and cultivation, and I have therefore made another tapping of the tree, now sixteen years old, growing in the Waterfall Garden, to which reference has been made in previous Annual Reports. This tree has now been tapped five times on the dates and with the result given below.

	lb.	oz.
November-December, 1898, Yield of dry Rubber	...	3 0
April-May, 1899, Yield of dry Rubber	...	2 8
November-December, 1899, Yield of dry Rubber	...	3 4
October-November, 1900, Yield of dry Rubber	...	3 12
August-September, 1901, Yield of dry Rubber	...	2 2½
Total of five tappings	...	14 10½

So far as can be seen no injury whatever has been done to this tree; it looks healthy and produced this season a good crop of seeds. The last tapping was done during a period of very wet weather, the rainfall being 24.52 inches, or a little over an inch a day during the twenty-three days the tapping was carried on. Whether this affected the yield of latex or whether the tree requires a longer period of rest can only be ascertained by a further experiment under different weather conditions, and this will be done before long. At any rate the quantity of rubber is less than that obtained at either of the previous tappings. I have not the slightest doubt however that during the next four years, by the end of which time the tree will be twenty years old 5 lbs. 5½ ozs. more rubber can easily be extracted (probably very much more) this bringing up the yield to twenty pounds or an average of 1 lb. per year for every year of its life. Assuming an estate with 100 trees to the acre as good as this one, and the value of rubber at 3/- per lb. only, below which it is scarcely likely to fall, and which is about 25% below the present price of fine para, we have as a return in twenty years 2,000 lbs. of rubber of the value of £300 or an average of £15 per acre per annum from the time the trees were planted. After deducting all expenses this should leave a handsome profit without any consideration as to subsequent profits. Samples of the rubber from this last tapping, which was coagulated

by the addition of a few drops of acetic acid, and not smoked, was submitted for valuation to three quite independent experts, two in England and one in America, and they all agree in valuing it at from four pence to six pence per lb. less than previous samples from the same tree which coagulated naturally and had been smoked. All remark that the rubber is good but that there appears to be something wrong in the curing. I was induced to try this method after seeing some nice looking samples prepared in this way and exhibited at the Penang Agricultural Show, but it does not appear to be a method to be adopted. It is possible that too frequent tapping may cause deterioration in the latex and whether this be so or not will be proved in the next tapping. The valuers however all remark that the fault appears to be in the curing.

Gutta Jelutong.

21. A sample of Gutta Jelutong received from the Senior District Officer, Province Wellesley, was sent to the Director, Royal Gardens, Kew, who submitted it to the well known brokers, Messrs. HECHT, LEVIS & KHAN who state that it is known in the London Market as "Pontianak," and estimated the value in October at £19-20 per ton. The tree from which this is obtained (*Dyera costulata*) is fairly common throughout the Peninsula and in the Islands of the Malayan Archipelago.

Botanical Expeditions—Langkawi.

22. In addition to the two expeditions to Indragiri in Sumatra, and to Muar in Johore territory, especially in connection with the collection of gutta percha plants or seeds, a short trip was made to the Langkawi Islands in November for the purpose of collecting botanical specimens. On this occasion I was absent from Penang five days, the greater portion of two of them being occupied in going and returning. During this short trip many interesting and, I believe, some new plants were collected. I went up to a small Island called Pulau Hujung Duri which is about fifteen miles further North than I had been on any previous occasion. This Island does not exactly belong to the Langkawi cluster but rather to a small group closer to the main land off the Malay State of Satul, from the North end of it the small village of Wala Bara on the mainland is distinctly visible. At this point the hills come quite close down to the sea, and our Langkawi pilot, who knows the place well, says they are inhabited by Sam-Sam. We anchored the Launch in a beautiful little bay with four fathoms of water and circumnavigated Pulau Hujung Duri in one of the boats. The Western side, which is exposed to the full blast of the South-West Monsoon, is very rugged, and the vegetation less varied and luxuriant than on the Eastern side. The striking features on the West side are giant Euphorbias and a species of Pandanus in great numbers. The hard woody portion of the former is in great repute as a medicine for bowel complaints under the name of Tras Sudu. While at Kuah I made some inquiries about guttas as I was desirous of satisfying myself as to what kind of tree produces the article that is exported from these Islands under the name of "gutta minjato." Having now seen leaf specimens I have little doubt that it is a species of *Bassia*. It is a low grade gutta of no great market value. Gutta taban, that is to say *Palaquium* species, which are the only trees yielding true gutta percha, do not extend so far north as these Islands. I have made careful inquiries on this point on this and previous visits, and have now no doubt that Penang is almost the Northern limit of these trees. The two largest Islands of this group, Langkawi and Trutau, contain some excellent timber of which the greater portion comes to Penang. I saw on the beach at Kuah some fine straight logs over sixty feet long and fourteen inches square which had been cut for the new tin smelting works in Province Wellesley. The working of timber was also commenced some time ago at Pulau Adang, a large Island to the West of Langkawi, and which so far as I know has not yet been visited by any botanist, but the men and buffaloes have been brought away and the work stopped on account of fever.

Perak.

23. The Christmas holidays were spent on the Perak hill, and by permission of the Hon. Resident Councillor, I took with me a man from the Garden to assist in collecting plants for cultivation in the Waterfall Garden, and for the purpose of exchange. Few of these mountain plants grow well for any length of time when brought down to the hotter and drier region of sea level, but many of them live long enough to produce flowers from which drawings can be made.

The past year appears to have been a great flowering one as regards forest trees in Perak as well as in Penang, as can be seen from the myriads of young seedling plants of all kinds everywhere. We brought back a large collection of Orchids, Aroids, Ferns, Gingers, Gesneriaceæ, Melastomaceæ and other small growing plants suitable for pot culture. Rhododendrons, of which I collected three species, have, I am told, been a wonderful show, but the season was over at the time of my visit as was also the case with the majority of trees.

C. CURTIS,

Assistant Superintendent of Gardens, Penang.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1901.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden ...	4,500 00	{ Wages of Gardeners and Coolies 3,394 14 Purchase of Plants and Seeds ... 101 46 „ Pots and Tubs ... 129 50 „ Manure and Cartage ... 55 00 „ Material for Herbarium ... 29 80 „ Books and Periodicals ... 32 22 „ Planks for boxes, &c. ... 94 07 „ Material for repairs ... 294 50 „ Material for new plant shed 164 16 „ Tools ... 86 94 Miscellaneous Petty Expenses... 113 03	4,494 82 5 18 4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow	1,000 00	{ Wages of Gardeners and Coolies 801 58 Purchase of Seeds ... 67 13 „ Manure ... 48 25 „ Pots and Tubs ... 26 80 „ Tools and Materials ... 52 55	996 31 3 69 1,000 00
Government Grant— Reafforesting Site of Ex- perimental Nursery ...	300 00	{ Wages of Coolies ... 167 23 Balance ... 132 77	300 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance ...	730 00	{ Salaries and Wages ... 708 00 Balance ... 28 00	736 00
Government Grant— Travelling and Personal Allowance ...	411 00	{ Pony Allowance ... 216 00 Expenses in connection with journey to Indragiri ... 168 60 Expenses of trip to Langkawi ... 36 54 Field Allowances ... 13 50	434 64 6 36 441 00
Grant Total Government Grant ...	6,941 00	Grand Total Expenditure ...	6,801 00
Revenue from Plant Sales	\$ 585 50		
„ Swimming Bath	18 00		
Total Collected	\$ 603 50		

APPENDIX B.

BOTANIC GARDENS,

Penang, 13th February, 1902.

SIR,—In a separate letter I have furnished for the information of His Honour the Officer Administering the Government a brief general report on my journey to Indragiri on the coast of Sumatra, and in this I purpose to deal exclusively with the gutta percha question which was the main object of my visit.

2. There is not the slightest doubt that all kinds of gutta percha trees are being rapidly exterminated in this part of Sumatra and it is a difficult matter to find a tree over six inches in diameter. I made inquiries at all places touched at going up the river, and at the farthest point I reached, which is about one hundred and fifty miles up the Indragiri river, I spent three days in examining the forest and in making further inquiries, but in no single instance could I see or hear of a tree large enough to produce seeds, so that I think we may dismiss the idea of obtaining seeds from this region. Mr. BURCHARD, the gentleman whose estate I stayed at, is interested in this subject and has planted some thousands of trees of *Palaquium*. He has been living over four years in the same place and is aware of the value of seeds, but during the whole of that time has not been able to obtain one.

3. Four kinds of gutta percha trees are found growing in this district and some of each kind are planted on the estate which I went to visit. They are all known as "Balaïn" i.e. Balam Merah, (*Palaquium oblongifolium*) which is the same thing as Taban Merah of the Peninsula and Ekor of Penang, Balam Putih (*Palaquium* sp.) and Balam Sundek (*Payena Leerii*). I obtained leaf specimens of all these trees and saw the manner in which they have been planted. "Balam Merah" produces the most valuable gutta percha and is the one that it is desirable to plant in this Colony as in addition to its higher market value gutta percha is obtainable from the leaves as well as from the stem, and I think it doubtful whether this is the case with the others.

4. The planting has not been done in a systematic manner, but trees set out at varying distances apart between Coffee and Gambier. In some places they are thirty feet apart and in others only twelve. Owing to want of capital the greater portion of the estate has been practically abandoned and the jungle has grown up and ruined the Gambier, but where the heads of the gutta trees have been kept clear the effect has probably been beneficial to them rather than otherwise. A great number of trees appear to have died when first planted, owing largely no doubt to the inexperience of the coolies, but mainly from the fact that the stumps were brought direct from the dense damp jungle and planted in the open without any previous preparation.

5. During the first two years all the species of *Palaquium* grow slowly, but after that appear to get away faster. The height of two years planted trees I found to be six to eight feet with stems $\frac{3}{4}$ "-1" in diameter at the base. Those four and-a-half years planted are ten to thirteen feet high and six to nine inches in circumference at three feet from the ground. The soil in which they are growing is excellent, much better than anything we have in Penang or Malacca.

6. In the absence of seeds the difficulty of obtaining a sufficient number of suitable plants to form plantation on a large scale in Malacca and Penang is a serious and somewhat expensive matter, but to wait for a seed crop may mean waiting for years. In the first place *Palaquium oblongifolium* trees do not flower annually. When they do flower it sometimes happens that animals take the crop. In support of this statement I may say that none of the trees in Penang flowered last year, nor am I aware of their having flowered more than once during all the years I have been here, which was in 1899, when we obtained a thousand young seedling plants. Mr. RIDLEY informs me that one tree in the Botanic Gardens, Singapore, flowered freely but set no fruit. Mr. DERRY wrote some time ago that a tree in the Residency grounds at Kuala Kangsar was in fruit, and two months later that squirrels had taken all except two which he sent me while still unripe. Under these circumstances it does not seem advisable to sit down and wait for seeds, and the only course open appears to be to purchase seedling plants as young as possible from the jungle, or plants propagated from cuttings.

7. The main object of my journey to Indragiri was to see how this tree is propagated from cuttings, for all attempts made here have proved a failure. I know now how the thing is done, and it is as I suspected, but as the system depends on a large supply of small plants to work on we cannot apply it to any considerable extent.

in Penang. I am in hopes however that a fair proportion of cuttings from large trees treated in the same manner will succeed and experiments will be commenced as soon as the season is suitable.

8. The so called young plants used for propagation (which I prefer to call stumps to distinguish them from truly young seedlings or cuttings) are found plentiful in places near where I was staying. They are in reality old suppressed seedlings from the size of a lead pencil to that of a man's little finger, with a long tap root two to three feet long, as thick as a man's thumb, and perhaps twenty or more years old. They are pulled up and cut back to within about six inches of the point that was level with the ground; and then planted horizontally on a sloping bank in damp shady jungle until they make new erect shoots at right angles to the stem with two or three fully developed leaves, when they are cut off with about two inches of the old wood attached, and planted in boxes until they root. The process is a slow one, and plants large enough to put out in plantations cannot be produced in less than eighteen months. When once rooted they grow well and make good plants. We received a box of these cuttings last October when only a few of them had roots, and in January they had rooted and were potted off singly in five inch pots. Next to seedlings collected in a very young state these are the best plants I have seen.

9. In the Singapore Gardens I saw a number of young seedling plants that had been brought from Borneo, and if plants of this stamp are obtainable they should be purchased in large numbers for Malacca and Penang and forwarded in the boxes as they arrive to Nurseries as near as possible to the places in which they are to be eventually planted. I also saw in the same place a number of boxes of stumps of which I have no very high opinion, unless they are utilised for propagation in the manner I have already described in paragraph 8. I doubt whether these old stumps, from which one half the tap root has been cut in order to get them into boxes, will ever make satisfactory growth.

C. CURTIS,

Assistant Superintendent of Forests.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

FOR THE YEAR

1902

BY

H. N. RIDLEY, Esq.,

Director.



PUBLISHED BY AUTHORITY

SINGAPORE :

PRINTED AT THE GOVERNMENT PRINTING OFFICE.

1903

Annual Report on the Botanic Gardens, Singapore, for the year 1902.

Staff.

The Director returned from leave on March 18th, 1902, and the Assistant left on long leave on March 23rd. For some months there was no Assistant in the Gardens, and as the available portion of the salary of the Assistant, is insufficient considerable difficulty was experienced in inducing anyone to take the post. It has long been impossible for a single European, however energetic, to get through the work of the Department and, as may be expected, almost every branch of the work had fallen into arrears. Mr. A. D. MACHADO accepted the post of Assistant on July 1st, and it then became possible to get the Department into something like its proper condition.

The scheme of salaries for the mandors referred to in the last report did not give satisfaction to the employés. It amounted to a commencing salary of 20 dollars per month rising 5 dollars in every fifth year to 40 dollars, the maximum previous service at or over 20 dollars counting. Two of the three Garden mandors and one at Government House sent in a petition to be raised to the maximum at once; this was refused, and they all resigned. One of them, MOHAMED HANIF, had been employed for seven years consecutively as mandor, and for three years previously with a break between, so that he had had ten years training. His salary was 25 dollars.

The mandor SAHIB, who had resigned with the others, applied to be taken on again and this was permitted. VICTOR PASSANAH replaced HANIF in charge of the Economic Gardens, and a lad EZEKIEL was taken on in place of a mandor CHINTA who was dismissed. CASTAWI, a Javanese who has been employed in the Gardens since boyhood, was put in charge of the flower beds, etc.

This constant change of mandors, and the consequent work of training utterly ignorant men, adds not a little to the work of the Department.

The coolies, with the exception of one or two of the older men, were a very poor lot, very indolent and thievish, and one of them out of spite attempted to burn down the mandor's quarters, a design happily frustrated.

The supply of both Javanese and Klings was by no means adequate, and it seems at present impossible to procure more.

The peon SALLEH was arrested on a charge of fraud and sent to gaol for three months, being the second successive peon who was thus imprisoned. Considerable difficulty was experienced in getting a successor, as the work is hard, and long, and the fact that the peon has to act also as bill-collector and has many opportunities of fraud makes it essential to get a trustworthy man. It would be advisable to require the peon to find security.

There was very little sickness among the coolies except that dengue fever ran through the whole staff, and there was one case of beri-beri which ended fatally very suddenly.

Weather.

The weather was unusually dry and hot for many months, and this entailed a great deal of watering. All the wells being dry, water had to be fetched from the lake by bullock cart, employing a good many men and costing a good deal of money in cart hire.

In spite of all these difficulties and drawbacks to which must be added the very large increase in cost of all materials used in the Gardens, the Gardens were kept bright and improved in many ways and before the end of the year were got into good condition again.

Visitors.

The number of ordinary visitors was as great as usual, and there was an increase in the number of Scientific and Gardening Men who came to study plants and

methods of cultivation and preparation of vegetable products. Among the latter were M. DUPONT sent by the Seychelles Government to study tropical products, with a view to introducing them into the Seychelles. Mr. MERRILL, Government Botanist for the U. S. A. Government at Manila; M. BOIS of the Paris Museum; Mr. USTERI of Zurich, Mr. NITOE, Chief of the Agricultural Bureau, Formosa; Prof. COMES, School of Agriculture, Portici; Dr. P. DE TAVERA, Member of Philippines Commission; H. FOSKOUBA, Director of the Imperial Garden, Shinjicou, Japan; Prof. T. TANAKA, Central Experiment, Station, Tokyo; Dr. VOLZ (Sweden) and Sir E. SATOW.

The Regimental bands played as usual on moonlight nights and on afternoons, and were highly appreciated.

Upkeep of Buildings &c

No new buildings were constructed but repairs and alterations were made to the cooly lines, the large plant-house and the smaller buildings. Some of the drains by the roads were reconstructed and more will have to be done. At the request of some members of the public the paths on the bandstand were covered with a layer of white sand for the benefit of the children who play there which gave much satisfaction to them and their parents, though by no means beneficial to the grass.

All garden seats have been repaired during the year and fresh seats purchased.

Aviaries.

In accordance with the Government instructions all the larger animals were disposed of, some being sold. The deer were sent to Cocos Island to resupply the stock formerly there. Only a few of the smaller animals and birds are now kept, chiefly those which have been here many years. No attempt will be made to add any more; indeed a number of animals offered by various persons were declined.

The old wire netting on two sides of the monkey's cage was replaced by iron bars at a cost of \$260.

One bamboo rat (*Rhizomys*) was presented by the Hon. R. N. Bland, Malacca.

One pelican (*Pelecanus* sp.) captured in Singapore was purchased.

One Hornbill (*Berenicornis Comatus*) was presented by a passenger.

One squirrel (*Sciurus Prevosti*) presented by Mr. A. D. Machado.

Two silver pheasants (*Euplocamus Nycthemerus*) presented by Mr. Falshaw.

One sparrow-hawk presented by Mr. Kesting.

The fine peacock was found dead one morning, having apparently been killed by a wound under the eye given by a pheasant in the next cage.

Plants and seeds received.

There were 332 packets of seeds, and 1,528 plants received as presents or in exchange from various Institutions and private persons. The contributors were Royal Gardens, Kew; Botanic Gardens, Sierra Leone, Uganda, Calcutta, Ootacamund, Penang, Jamaica, Melbourne, Nagpur, Trinidad, Cape Town, Sydney, Bermuda, Berlin, Dar Es Salam. The Agri-horticultural Societies of Calcutta and Madras, U. S. A. Department of Agriculture, Messrs. J. C. Harvey (Mexico), M. Prudhomme (Madagascar), Dr. Schlechter (New Guinea), Messrs. Boehmer (Japan), Mr. E. S. A. Cohen (Java), Mr. Micholitz (East Indian Orchids), Mr. J. C. Pereira (Orchids), R. Little, Mrs. O'Sullivan, Mr. S. P. Chatterjee (Calcutta), Mr. Gunn, Mr. St. V. B. Down, Mr. Jenkins (Bangkok), Messrs. Herb and Wulle, Mr. Choa Kim Keat, Mr. F. Pears (Muar), Mr. R. Derry (Perak Orchids).

Plants and seeds sent out.

There were sent out from the Gardens to various institutions and private persons 775 packets of seeds and 2,181 Plants, besides which there were sold to various purchasers 829 Ornamental plants, 4,763 Economic plants, 125,110 Para rubber seeds and 100 packets of various seeds.

Seeds and plants in exchange were sent to the Gardens of Kew, Buitenzorg, Calcutta, Saigon, Bermuda, Madagascar, Uganda, U. S. Forest Bureau, Manila, Brisbane, Seychelles, Rockhampton, Ahuri, Trivandrum, British New Guinea (14 cases of plants), Sydney, Ceylon, British Guiana, Calcutta, Trinidad, Penang, Melbourne, Hongkong, Bangalore, Mauritius, Jamaica, Adelaide, Rangoon, Zanzibar, Travancore, Old Calabar, Baroda, Barbados, Malta, Kuala Lumpur, Agri-horticultural Society of Calcutta and Madras, British Legation, Bangkok, British North Borneo Government, Paris Museum, Forest Department and Gardens, Malacca and Negri Sembilan, Experimental Gardens, Batu Tiga, Administrator of Fiji, Kapalgoo Mission, Port Darwin,

Dr. Schlechter, Messrs. Vanden Gucht, Beaufort, (Chinde E. Africa), Hemings (Fiji), Harvey (Mexico), Chatterjee, Pereira, F. Pears, and others.

The number of plants and seeds received and sent out this year far exceeds that on any previous year in the records of the Gardens. The increase in the demand for plants from these Gardens is due not only to the development of the British tropical colonies, especially Africa, New Guinea, Seychelles and the Malay States, but also to the fact that these gardens are now considered to rank among the most important of the equatorial tropical stations of the world, so that all questions and requirements of tropical cultivated plants are referred to this department from the various foreign Colonies as well as from those of Britain. This not only entails a very large stock of cultural plants being kept, but increases the correspondence enormously, so that this Department has probably by far the largest correspondence of any in the service.

Plants in Flower.

The following plants flowered in the Gardens, for the first time, *Millettia Albiflora*, (tree) from Pahang, *M. atropurpurea*, *Napoleona imperialis* (shrub) West Africa, *Bassia* sp. Getah Soontai, Sumatra, *Kickxia africana* (tree) Africa, *Mascarenhaisia elastica* (Rubber tree) Madagascar, *Webera asiatica* (shrub) Ceylon, *Allamanda violacea* (shrub) Brazil, *Passiflora Watsoniana* (climber), *Posoqueria longiflora*, and *P. latifolia* (shrubs) South America, *Pavetta madagascariensis* (shrub) Madagascar, *Abutilon* sp. Madagascar, *Landolphia hendelotii* (Rubber vine) Africa, *Ichnocarpus frutescens* (climbing shrub) Penang, *Dipterix odorata* Tonquin Bean, *Homalium grandiflorum* (Tree) Singapore, *Coffea* sp. Abbeokuta coffee, *C. Laurentii robusta* Congo Coffee, *Aristolochia Duchartrei*, (climber) South America.

Saccolabium fissum (Orchid) Lankawi, *S. secundiflorum* Sinkep, *Cælogyne kingii* Perak, *Renanthera coccinea*, *R. Imschootiana* Indo-china, *Vanda limbata* Celebes, *Calanthe microglossa* n. sp. Sumatra, *Sabal glaucescens* (Palm) Trinidad, *Iguanura* sp. "Teruno" Dindings, *Zamia pumila* America, *Carludovica humilis* S. America, *Calamus Lindeni* Philippines.

Cola acuminata and *Allamanda Williamsi* fruited for the first time.

Library.

The following books and periodicals were added to the Library :—

Niederlin, G.—The State of Nicaragua; presented by the Author.

Agricultural and live stock Statistics, presented by the Government of S. Australia

A public Institution devoted to the Ex-	}	Issued and presented by the Philadelphia Commercial Museum.
tension of American Commerce		
The Worlds Commerce		
Conversion tables of Weight & Measures		

Merck, E.—Recent clinical reports on Iodopin; presented by the Author.

Morrison, W. K.—Bee keeping in the West Indies.

Alford-Nicholls, Dr. H. A.—The harmfulness of Bush fires; presented by Imperial Department of West Indies.

Seedling and other canes in the Leeward Islands; presented by Imperial Department of West Indies.

Pieters, A. J. and Charles, V. K.—The seed coats of certain species of Brassica; presented by U. S. A. Government.

Howard, L. O.—The Economic Status of Insects, presented by U. S. A. Government.

Wildeman, Ede.—Observations sur les Apocynacees á latex; presented by the Author.

Hackel, E.—Neue Graser; presented by the Author.

Wright, H.—Observations on *Dracœna reflexa*; presented by the Author.

Heim, Dr.—Recherches des Dipterocarpees; presented by the Author.

Angler, A.—Monographien Afrikanische Pflanzen und Gattungen Vol. III. IV. V.; presented by the Author.

Dyer, Sir W. T.—The flora of tropical Africa; presented by the Author.

Sack, J.—Einiger Pflanzenstoffe; presented by the Author.

Cook, Theo.—Flora of the presidency of Bombay; presented by the Author.

Benson, C.—Sugar Cane of Madras; presented by U. S. A. Government.

Report on the United States Philippine Commission; presented by U. S. A. Govt.

Berichte Land und Forstwirtschaft in Deutsch Africa.

Appel, O.—Paul Knuth, presented by the Author.

- Knuth, P.—Bloemen biologische mededeeling aus den tropen ; presented by the Author.
- Preyer, Axel.—Einiges über Sudasiatische Agricultur ; presented by the Author.
- Preyer, Axel.—Über kakao-fermentation ; presented by the Author.
- Urban, J.—Vorgeschichte des Neuen kgl. Botanisch Gartens zu Dahlem-steglitz ; presented by the Author.
- Christ, H.—Elaphoglossum Bangii ; presented by the Author.
- „ Spicilegium pteridologicum Austro-Braziliense.
- „ Aspidium munchii.
- „ Filices setciouenses.
- „ Die Farn flora der Ostliche Riviera.
- Raciborski—Farne von Tagal.
- Agricultural Imports and Exports 1897 ; presented by U. S. A. Government.
- Our Foreign Trade 1892-1901.
- Lloyd.—Mycological notes.
- Arden, S.—Report on Para Rubber, Selangor.
- King, Sir George.—Materials for the Flora of the Malay Peninsula (continuation). Report of Agricultural Experiment Station ; presented by U. S. A. Government of the University of Wisconsin.
- Moore, R. A.—Oatsmut in Wisconsin.
- Mohr—over het Oopten van Delie Tabak.
- Kramer, Dr. J. G.—Ground Analyses.
- Koningsberger, J. C.—De Zoogdieren van Java.
- Proceedings of the Central Indigenous Drugs Committee of India—Vol. 1 ; presented by Government of India.
- Niederlein, G.—Ressources vegetales des Colonies Francaises ; presented by the Author.
- Ferguson, M. C.—Germination of the spores of Agaricus Campestris.
- Green, A. O.—Tasmanian Timbers ; presented by the Author.
- Medley Wood, J.—Natal plants, Vol. 3 ; presented by the Author.
- Wildeman,—Illustrations de la Flore du Congo ; presented by the Author.
- Kearney, Th.—Report on Botanical Survey of the Dismal Swamp region ; presented by U. S. A. Government.
- Coulter and Rose—Monograph of the North American Umbelliferae ; presented by U. S. A. Government.
- Lyon, W. S.—A primer on the Cultivation of Sugar-cane ; presented by Philippine Bureau of Agriculture.
- Engler—Der Pflanzenreich (Purchased)
- Hannam, W. J.—Textile Fibres of Commerce „
- Blume, C.—Bijdragen tot de Flora van Nederlandsche India : Tabellen „
en Platen v. d. Jav. Orchideen „
- De Sturler, W.—Catalogue des especes de Bois de l'Archipel des In- „
de Orientales „
- Hagen, Dr. B.—Die Pflanzen und Thierwelte von Deli „
- Scheffer, R. H. C. C.—Observationes Phytographicae III. „
- „ Sur quelques Plant Nouvelles „
- Choisy, J. D.—Plantæ Javanicæ „
- Miquel, F. A. G.—Analecta Botanica „
- Warburg—Monsunia Vol. 1. „
- Rodrigues, J. Barbosa—As Heveas „
- Botanical Magazine, Journal of the Linnean Society, Indian Gardening and Plan-
ting Gardeners Chronicle. Tropical Agriculturist, Dictionnaire Iconographique des
Orchidees.

The following journals and reports were also presented :—Journal of the Board of Agriculture, The Indian Forester, Journal of the Imperial Institute, The Chemist and Druggist, Botanical Survey of India, Journal of the Department of Agriculture of W. Australia, Queensland Agricultural Journal, Agricultural Journal of the Cape of Good Hope, Jamaica Bulletin, Saigon Bulletin, Kew Bulletin, Trinidad, West Indies, Ceylon, Annals of the Buitenzorg Gardens, Land record North West Provinces, Bulletin of the Koloniaal Museum te Haarlem, Journal d'Agriculture Tropicale, Revue des Culture Coloniales. Tropenflanzer, The Pharmaceutical Review, Bulletin du Jardin Colonial, Agricultural News (Barbados), Agricultural Ledger (India), Bulletin of the University of Wisconsin, Planting opinion of India, Bulletin Economique, Acti Horti Petropolitani, Experimental Station Record (U. S. A.), Bulletin de la Chambre d'Agriculture, Annales du

Musee du Congo. Madagascar Bulletin. The Shamba (Zanzibar), Agri-Horticultural Society, Madras, and the annual reports of the Gardens of Natal, Ceylon, Trinidad, Hongkong, British Honduras, Zanzibar, Zurich, Calcutta, Buitenzorg, New South Wales, Travancore, Barbados, Antigua, Mysore, British Guiana, Gold Coast. Forest, Department, Madras, Uganda, Queensland Acclimatization Society, Smithsonian Institute, Washington.

The Flora.

During my stay in England, I examined and compared the Aroids, and Calameæ of the Singapore Herbarium with those of Kew Gardens and published an account of new species of Aroids from the Peninsula in the Journal of Botany. The volume of the Flora including the Monocotyledons having been entrusted to me, I have finished the *Hydrocharideæ* and *Orchideæ* and the manuscript has been typewritten, the remainder of the orders with the exception of the Glumales have been written out and are nearly ready for the typewriter. I hope to finish the work in a few months. I have also undertaken to do the order *Gesneraceæ*.

The Artist has continued to make drawings of the more interesting plants.

Bulletin.

The Bulletin was published regularly each month, and to judge by the demand for it may be considered very successful. The first volume of the new series was completed at the end of the year. It included 616 pages of letter press and 8 Plates.

Three hundred and thirty copies were distributed to various establishments and private persons each month, beside separately purchased copies. It was not expected at first that there would be so great a demand for it, so that of some numbers no copies remain in stock.

Herbarium.

Comparatively few specimens were added to the herbarium this year, as owing to stress of work it was not possible to visit the forests. I went to Penang however in December, and got three days' collecting in the Perak Hills; though the time was short I obtained several new and little known plants including three Pandani, several Rattans in flower, and a remarkable Balanophoraceous plant, probably generically new, and such rare and little known plants as *Chrysoglossum villosum*, and *Zingiber Kingii*.

Herbarium specimens were also received during the year from Mr. Curtis (Penang and Malacca), Mr. R. Shelford (Sarawak), Dr. Prain, specimens from Scortechini and Kunstler's collections, together with some copies of drawings of rare species. Mr. E. Merrill (plants of Labuan), Mr. Penny, specimens of wood, leaves and fruit of the catinga from Pahang. Mr. Craddock, Pahang plants, Mr. Micholitz, *Balanophora* n. sp. Tenimber islands, and specimens of rare plants were sent by Messrs. Derry, Arden, Burn-Murdoch and Machado.

Duplicate specimens from the Herbarium were sent to Kew (146), Sydney Botanic Gardens (479), Calcutta (212), British Museum (120) and some palm and pandanus specimens to Dr. Beccari. A collection of specimens of Economic plants was prepared for Prince Roland Buonaparte.

Economic Gardens.

In this part of the Garden, a large piece of ground, lying between the new road and the Arboretum on the east side, was cleared, stumped and partly turfed. This much improves the appearance of this portion of the Garden. The boundary on this side was also cleared, and a hedge planted. A number of new nursery beds were formed, and the stock of Economic plants for distribution having got very low was renewed as much as possible, but owing to the drought and change of mandors, it was difficult to get a large enough supply for the demands.

Para rubber.—The demand for seeds and plants of this fell off materially as many of the trees planted in the Native States and Malacca are fruiting now, and the planters are now supplying themselves. The number of seeds sold or otherwise distributed was 126,210, young plants .

Owing to the drought the crop was very late and smaller than usual; experiments were made in tapping but were not completed as owing to the drought, the latex escaped very slowly and in small quantities.

Experiments were made in manuring young plants in pots, with various kinds of manures, including lime, cowdung, burnt earth, poudrette etc. The evidence, was in

favour of burnt earth and cowdung; lime and poudrette seemed not to benefit the plants at all.

Brucea Sumatrana.—This new dysentery drug was introduced to Singapore from Pahang in 1892, by myself, and its use in cases of dysentery described in the bulletin of this year. There was a fairly good demand for it from varied parts of the world especially India, and a piece of ground was planted up with it. The shrub fruited in 6 months after planting, and grew very readily. A bag of ten pounds weight of seed was sent to Messrs. BURROUGHS AND WELLCOME, for experiment.

Among the plants of economic value received during the year were two species of Anona from Mexico with edible fruit, *Eugenia owariensis* "Nsali" with eatable fruit, the Nyasa Land Coffee, and the "Masanda",—an *Artocarpus* with edible seeds, and some *Amomums* from Uganda, the Rotan Segar, *Calamus* sp. from Muar, the best rattan in the Peninsula; Seeds of *Bambusa spinosa*, *Dendrocalamus strictus* and 16 bags of *Swietenia Macrophylla* from Calcutta, *Copernicia cerifera* Wax Palm, from Guiana, Javanese vegetable seeds from Mr. COHEN, American vegetable seed from U. S. A. Department of Agriculture.

The chief demand for economic plants besides Para rubber, was for Fruit trees, and Vanilla. Large collections of various economic plants were supplied to British New Guinea, the Seychelles Gardens and the experimental station of Selangor.

Upkeep of Economic Gardens Vote ...	...	\$1,888.00
Expenditure ...	...	\$1,879.50
Balance ...	...	\$ 8.50

Inspection of Coconut Trees.

During the year notices to cut down infected trees were served on 238 persons and 1,039 dead trees and 35 piles of rubbish were destroyed. There were no prosecutions. The number of red beetles especially has greatly diminished in Singapore, so that it was some time before I could get a couple for a correspondent in Madagascar who wished to see it.

Vote ...	...	\$210.00
Transport ...	...	169.60
Uniform ...	...	17.50
Balance ...	...	22.90
		\$210.00

Upkeep of Government House Grounds and Domain.

The mandor Tajuridin resigned early in the year and was replaced by Rappa, who has worked very well. The coolies worked satisfactorily, a new bit of ground was opened as a vegetable garden, and produced a quantity of vegetables, and the grounds were kept in good condition.

Vote ...	...	\$2,024.00
Expenditure ...	...	1,955.57
Balance ...	...	\$ 68.43

Planting in Forest Reserves.

There was still a good deal of fever among the men engaged at Bukit Timah forest, and eventually the Mandor Castawi was removed from there and transferred to the Botanic Gardens. The six men worked well and 14,000 trees, chiefly Gutta Percha, were planted. The young trees were cleaned up and the paths opened where they had got covered. As a portion of the reserve was alienated by Government for cooly lines for the quarry, all the trees on it that could be moved were transferred. The hot weather interfered a good deal with the planting but the Gutta plants seemed to suffer very little from it. Some of the wild Gutta percha trees fruited in the forest, as they did in the Gardens, and a quantity of seed was obtained which

was planted. The greatest difficulty was to prevent their being carried off even ere ripe by bats. These are most troublesome animals, the worst being those of the genus *Cynopterus*, they occur in enormous numbers, and being small are impossible to shoot.

This plantation was transferred at the end of the year to the Forest Department.

Vote	...	...	...	\$600. 00
Expenditure	...	...	...	592. 13
			Balance	\$ 7. 87

HENRY N. RIDLEY,
Director.

Statement of Receipts and Expenditure for the year 1902.

RECEIPTS.		EXPENDITURE.	
	\$ c.		\$ c.
By Balance in Bank	... 2,797 51	Salaries	5,759.67
„ Government Grant	... 8,000 00	Bills	8,338.03
„ Sale of Plants, and Seeds	... 3,460 53	Balance	194.07
„ Interest	... 33 73		
	\$14,291 77		14,291.77

Botanic Gardens, Penang.

The year was an unusually dry one for Penang, the total rainfall on Government Hill, which is always greater than in the plains, being only 115.51 in., whereas the average for a number of years is about 150 inches.

Waterfall Garden.

For several weeks during the early part of the year a Surveyor was employed by the Municipal Commissioners in taking levels in this Garden, and a number of coolies in sinking a shaft outside the Garden limits to ascertain the nature of the foundation, their idea being to apply to Government for permission to convert the Waterfall Valley, the present site of the Garden on which much labour and money has been expended, into a reservoir. No definite decision has as yet been come to, but the chalk line and level pegs put down by the Surveyor to show the height to which the water will

rise, supposing this scheme is carried out, shows that there will be nothing left worth preserving as a Government garden, and that an entirely new site will have to be selected if Penang is to have a garden of any interest. Under this circumstance of uncertainty no extension has been made during the year, nor have certain much needed improvements of permanent nature, such as increased Office and herbarium accommodation and Quarters for employes within a reasonable distance of their work, been put before Government as was intended in preparing the Estimates for 1903; as it would be wasting money if the garden is to be abolished within a year or two. It is most important that this question should be settled as soon as possible so that works of improvement may be carried on with a certainty that the labour and money is not being spent in vain.

2. This garden, as is often remarked both by resident and visitors, is the one show place in Penang, and in addition to this much work of a more utilitarian nature is done here in connection with Forestry, Economic Botany, &c. A large proportion of the trees are now too large to be removed and every year the difficulty and also the expense of removing is enhanced, so that I cannot too strongly urge the necessity of a decision being arrived at as soon as possible as to whether this is the only possible site for an adequate water supply; and if so that steps should be at once taken to provide for another suitable site for a garden.

3. The main attraction to the majority of visitors are the plant sheds, especially the Orchid shed, which generally contain a number of interesting plants in flower. In this respect there has been no falling off during the past year, and there is at the present time (January 8th) a bank of *Calanthes* and other Orchids in flower that is most attractive. The attention of plant lovers has been called to this easily grown and attractive genus in an article to be published in the *Agricultural Bulletin*, with hints as to their culture, so that there is no necessity to dilate on the subject here further than to say that since the beginning of September there has been a continuous show of those plants in flower which will continue for at least another month or six weeks. *Habenaria carnea* is another Orchid that served to keep the house gay during the months of July and August, there being at one time about 100 plants in flower, and the individual flowers last from a month to six weeks. Some of the *Cattleyas*, *Oncidiums*, and other S. American Orchids do fairly well and are greatly admired, but for the greater number of species of these genera the temperature is too high to grow them to perfection.

4. Beds, borders, and shrubberies were maintained in a satisfactory manner, and many plants and trees were more than usually floriferous when the rain came after the prolonged drought. The *Lagerstroemia* and *Cassia* trees were exceedingly showy as were also many flowering shrubs. Cannas are grown in large numbers and some three dozen new varieties were received from Messrs. Dammann & Co., Naples. This is one of the best flowering plants to grow for the wet season, but to obtain the best results they require to be transplanted frequently, and manured heavily. Many Palms and other trees were planted out in different parts of the grounds and more would have been done in this line but for the uncertainty as to what is to happen to this garden as already mentioned. Nearly the whole of the collection of pot plants were gone through and repotted during the months of April and May.

5. Numbers of new plants were contributed to the collection already in cultivation by the Officers in charge of Botanic Gardens, Nurseries, and other establishments, with which we are in correspondence; and a good many by residents in the Malay States, Sumatra and Penang. A trip to Selangor in the month of May, in connection with forestry, afforded an opportunity of adding many plants that are quite new, and others not previously recorded from the Peninsula. Among the former is a most beautiful *Didymocarpus* with snow white flowers, found growing at an altitude of about 3,000 feet; and among the latter, *Cypripedium Lowii*, which had hitherto been recorded only from Borneo, where it was first discovered by Sir Hugh Low, and in Sumatra. The mountain range on which these and many other interesting plants were collected divides the Native States of Selangor and Pahang, and is a region that from a botanical point of view will repay further exploration.

6. The principal contributors of plants and seeds are the Directors of the Royal Botanic Gardens Kew, and Calcutta; Botanic Gardens Buitenzorg, Glasnevin, Gold Coast, and Singapore. Among others may be mentioned Messrs. F. Sander & Co., Messrs. Dammann & Co., S. P. Chatterjee, C. Maries, Hon. J. K. Birch, J. de Voegt, D. Aeria, Khoo Joo Keat, Khaw Joo Tok, A. B. Stephens, A. Lens, J. Irving, L. Hawkins, D. Blaze, C. Goldham, A. Runge, Dr. Wright, Mrs. Ravis, P. Laurie, C. H. Sprenger and Mr. Stiedel.

7. The recipients were about equal in number to contributors and to a great extent the same individuals, but there are others, of which the Curator of the Botanic Station Seychelles, and H. H. the Rajah Muda of Kedah received the largest collections. Plants of *Kickxia* (*Funtumia*) *elastica* raised from seeds obtained direct from West Africa by the Superintendent of Government Plantations Selangor were divided between the Superintendents of Government Plantations Perak and Selangor, a few given to private planters, and some planted in Penang in the Forest Reserve at Batu Feringgi.

8. Plants to the value of \$741 were sold, the greater proportion being ornamental plants in pots, but included some 3,000 rubber plants of sorts. The greatest demand in the way of decorative plants is for Palms, the taste for which has greatly extended during recent years. The increase in revenue over the previous year's collection amounts to \$167.

9. Drawings of many new and interesting plants that have flowered in the garden have been added during the year, and it is hoped that more work of this kind will be done in the future as the Artist's time has hitherto been largely taken up with typewriting and other clerical work for which a man is provided in Estimates 1903.

10. Numerous additions have been made to the herbarium, which although confined exclusively to Malayan plants, has outgrown the accommodation provided. New Cabinets have been purchased but a larger and more suitable building is much needed.

Governor's Hill Bungalow Gardens.

11. This garden suffered much during the early part of the year from want of water. The rain-water tanks were all dry and the pump out of order. All the men employed could only carry enough water to keep the pot plants alive, and in many cases failed to do even that. Until there is some more satisfactory arrangement for supplying water it will not be possible to do much more in the way of growing choice plants here than is done at present.

Coco-nut Tree Preservation.

12. The Inspector of Coco-nut trees complains that in too many cases persons summoned for infringing the Ordinance are let off with a caution, or fined in so small amounts as to be non-deterrent. In view of the increasing importance of Coco-nut cultivation, and the necessity for keeping the beetle in check, for which it has recently been found necessary to take steps in the Federated Malay States on the same lines as in the Colony, I think too lenient treatment is a mistake.

The number of Notices &c., issued are shown below.

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District	480	2,770	168	89	383	7	\$ c. 15 50	
Province Wellesley, Central District	149	1,089	103	54	185	10	33 00	
Province Wellesley, Southern District	49	231	35	22	85	Nil	Nil	
Penang Island.	380	3,716	389	70	596	27	53 00	
Total.	1,058	7,806	695	235	1,249	44	101 50	

Economic Products.

13. Information regarding economic products, with which it has been customary

to deal at some length in successive annual reports, appears now in the regular monthly issue of the Agricultural Bulletin so that it is unnecessary to do more than refer briefly to the more important points in this branch of the work.

Para Rubber.

14. Para Rubber still holds the field and bids fair to recoup Agriculturists some of the money that has been lost in other cultivations. The largest tree in the Waterfall Garden, of which mention has been made from year to year in annual reports, has been tapped for the seventh time, the yield of dry rubber being 2 lbs. 13 $\frac{1}{4}$ ozs. which makes a total of 18 lbs. 7 ozs. from this tree in seven years, or an average of 2 lbs. 10 oz. per year; and I see no reason why this average should not be maintained or even exceeded without injuring the tree. According to a note in the Agricultural Bulletin, two of the oldest Para rubber trees in Perak that had not previously been tapped gave 50 lbs. of dry rubber at one tapping. Mr. STANLEY ARDEN, Superintendent of Experimental Plantation Selangor, has just published his report on the tapping of trees in various manners and at different ages, and I believe the conclusions arrived at coincide in all material points with my own experiments, which though dealing with only a few trees have been spread over a much longer period. The extension of plantations is pushed on, especially in the Native States, and it is proposed to commence tapping this year on two Estates that I know of, but I fear that the return from very young trees will be disappointing after deducting cost of collecting.

Ramie.

15. A short note on Ramie in the Agricultural Bulletin somewhat revived the interest in this fine fibre producing plant, and has resulted in eliciting some information that may be of practical value.

A correspondent in Scotland who is thoroughly conversant with the methods of cleaning and preparing this fibre, and to whom a parcel of ribbons was sent for treatment, suggests that the kind we sent, and which I believe to be the same that has been planted on the two or three estates in which the cultivation on ramie has been attempted on any considerable scale, is a very inferior variety which he terms black ramie. It is a very strong and quick growing form and on this account it has no doubt been selected in preference to others, but if our correspondent's views are correct this is its sole recommendation. We have in cultivation in the nursery here a smaller and shorter variety with hollow stems which will, I have little doubt, give more than double the weight of fibre from an equal weight of stems as compared with the large growing kind. The nature of the stem too, I think, simplifies the decortication process, for instead of stripping the bark from the wood, which is never a complete process, there being always a certain amount of fibre adhering to the wood, that cannot be removed with the bark, by simply beating the stems while in a green state and washing in water, every particle of fibre is obtained. From this variety two pounds weight of green stems without leaves gave 4 oz. of roughly cleaned fibre which has been sent home to ascertain what further loss occurs in completing the process of preparing the finished article, and the approximate value if shipped as per sample.

Gutta Percha.

16. Gutta Percha trees growing in the Waterfall valley, from which a good crop of seeds was obtained in 1901, produced not a single fruit this year though one tree flowered freely. Imported saplings both from Borneo and Sumatra are decided failures, and until seeds are obtainable the cost of forming large plantations is too great to justify the undertaking. This however is a matter to be dealt with more fully in a report on the Forest department which I have been asked by the Chief Forest Officer to write, and I merely refer to the subject here as the preparations of Gutta Percha plants for planting in the Forest reserves has hitherto been done in the Botanic Gardens.

Imperial Institute.

17. Early in the year samples of different kinds of "Gutta Percha" including "Taban Puteh" from Perak were forwarded to the Scientific Department of the Imperial Institute with the request that these might be examined and their commercial value reported on.

Later, a case of *Blumea balsamifera*, and seeds of *Hevea brasiliensis*, was sent.

Receipt of these packages has been acknowledged and an investigation of the contents promised as soon as an opportunity occurs. The Hevea seeds were sent at the request of the Superintendent of Government Plantations, Selangor, who anticipates that in the near future the supply will be enormous and that it is therefore desirable to ascertain whether they can be utilized in the production of oil, or for any other purpose.

Forests.

18. Up to the end of the year the Forests were directly under the District Officers and Collector of Land Revenue, the Superintendent of Gardens and Forests acting as adviser especially in the matter of planting operations, and additions or alterations in the area of reserved Forests. From the 1st January, 1903, a somewhat different system comes into operation whereby more direct control is taken by the Superintendent of Gardens and Forests.

Expenditure:

19. The total amount of Government Grants under the heading of Botanic Gardens amount to \$6,905, of which \$6,769.64 were expended, particulars of which are given in Appendix A annexed.

C. CURTIS,

Superintendent of Gardens and Forests.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1902.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant—		{ Wages	3,173 75
Maintenance of Water-		Stores, Tools and Material ...	653 33
fall Garden ...	4,960 00	Material for Herbarium ...	166 90
		Books and Periodicals ...	19 90
		Pots and Tubs ...	65 51
		Manure and Cartage ...	81 80
		Road Metal ...	69 00
		Freights ...	48 89
		Typewriter ...	211 75
		Office Furniture ...	20 00
		Cabinets for Herbarium ...	77 00
		Chicks for Plant Sheds ...	33 43
		Iron for renewing Plant Shed ...	190 16
		Miscellaneous & Petty Expenses	144 56
			4,955 98
		Balance ...	4 02
		Total ...	4,960 00
Government Grant—		{ Wages ...	943 59
Upkeep of Grounds of	1,180 00	Seeds, Plants and Tools ...	123 29
Governor's Hill Bungalow		Manure ...	64 89
		Pots and Plant Tubs ...	45 49
			1,177 26
		Balance ...	2 74
		Total ...	1,180 00
Government Grant—		{ Wages ...	101 78
Reafforesting Site of Ex-	200 00	Balance ...	98 22
perimental Nursery ...			200 00
		Total ...	200 00
Government Grant—		{ Pony Allowance ...	216 00
Travelling and Personal	416 00	Passages, Personal and Field Al-	199 22
Allowance ...		lowance ...	415 22
		Balance ...	78
		Total ...	416 00
Expenses of carrying out		{ Allowance to Inspector of Coco-	120 00
Provisions of Coco-nut	150 00	nut trees ...	4 00
Tree Preservation Or-		Destruction of dead Coconut	124 00
dinance ...		trees... ..	26 00
		Balance ...	150 00
Total Government Grant	6,906 00	Total ...	150 00
Revenue from Plant Sales	\$ 741 90		
„ Swimming Bath	32 20		
Total Collected	\$ 774 10		

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command of
His Excellency the Officer Administering the Government.

Annual Report of the Botanic Gardens, Singapore, for the year 1903.

Staff.

Mr. A. D. MACHADO, Acting Assistant during the absence of Mr. FOX, having accepted a position on an estate in Perak, resigned his post at the end of July. His services were so highly appreciated by the Government that he received a gratuity of \$500 from the Government. He was succeeded by Mr. C. B. KLOSS who remained till the end of the year, when Mr. DERRY was expected to return from England, which he did early in January. The salary provided for an Acting Assistant Superintendent is too small for an European to live on, about \$125 a month, so that it is by no means easy to get any one at all to act during the absence of either of the Superintendents, so that the Department was very fortunate in procuring the services of the above-mentioned gentlemen.

The Mandor VICTOR PASSANAH, who was employed last year, was dismissed, and his place was not filled up.

The collapse of the labour supply throughout the East was felt very severely in the Gardens. All the better class of the ordinary coolies left, and it was discovered late in the year that certain licensed cooly-brokers had been crimping the men and shipping them to Bangkok and Borneo. The men usually ran away immediately after receiving their pay and were not heard of again. This was discovered by one of the men who had been kidnapped against his will escaping from the house in which he had been locked up. In this way a very large number of men had disappeared. In fact, during the year, no less than 176 men ran away or were discharged for worthlessness out of a staff of 71 men, and this does not include a large number who came for a single day. The attention of the Chinese Protector in charge of the Emigration Department was called to the matter, the licence of one of the worst of the cooly-brokers revoked, and the running away of the men immediately stopped. The result of this wholesale exportation of labour was that the only coolies procurable were lads of 15 or 16 or old worn-out or diseased men rejected by the cooly-brokers, and for a good portion of the year the supply of these was inadequate. These coolies were not only lazy, but knew no Malay nor could most of them handle any tools. It was useless to discharge them as no others could be procured. At the end of the year matters got a little better, but many of those employed were of very little value.

The watchmen, although their wages were raised considerably, were almost equally troublesome, and several lots were dismissed during the year.

There was very little sickness throughout the year and none of any importance.

Visitors.

The number of ordinary visitors was as large as ever, but the residents do not make as much use of the Gardens as would be expected, except on occasions on which the regimental band plays. Performances took place not only on moonlight nights but also on Sunday afternoons on two occasions, and were highly appreciated especially the Sunday performances to which large crowds came.

The number of scientific visitors and those studying agriculture increases largely each year, as the Gardens are becoming more widely known throughout the world. Among this class of visitors may be mentioned:—Colonel LUMSDEN, Mr. DUNN (Hong-kong Gardens), Dr. HALLIER, M. BONNECHAUX, Mr. C. D. COBHAM, (H. M. Commissioner of Larnaca), Professor HOCHREUTNER, Dr. NILS SWEDELIUS, Baron DE SOSTEN, Professor C. S. SARGENT, and Mr. A. R. SARGENT, Dr. TREUB, Mr. W. R. TROMP DE HAAS, Dr. HEINRICHER, Professor PREUSS, M. JACQUET.

The tapping and other experiments with Para rubber attracted many planters and others interested in rubber planting, and there were often six or seven persons a day present while the rubber was being collected and prepared.

Thefts.

There were no thefts of any importance during the year, except those of a quantity of garden materials, evidently stolen for use in private gardens. A notice was published in the papers warning residents to be careful as to what their gardeners obtained, and the thefts which had been going on for some time immediately ceased.

Gardens Committee.

The meetings of the Committee for the management of the Gardens, after being long in abeyance, were recommenced at the request of a member of the Legislative Council. The members for the year were Dr. ELLIS, Hon'ble W. J. NAPIER, W. EVANS and Mr. JAGO who was during the year replaced by Mr. SHELFORD. Ten meetings were called, of which six were attended by the Committee.

Aviaries.

In accordance with Government instructions most of the remaining animals were sold; a few of the birds, some monkeys and a few other animals which had been a long time in the Gardens being kept. An unusually large number of animals were offered as presents to the Gardens, including a fine tiger offered by the Sultan of Johore, but almost all had to be refused. The abolition of the Menagerie caused many expressions of regret among the visitors with whom it was the most popular part of the Gardens. The funds however made it impossible to keep it up even if the dispersal of it had not been ordered.

It may be hoped that at some future time the Government might found a suitable Zoological Garden, in Singapore, which with a low charge for admission would easily be made to pay for its upkeep as is done in many colonies where the expenses of procuring the animals and keeping them are very much greater than they would be here.

The only animals accepted during the year were:—

A binturong (*Arctictis binturong*) presented by Mr. C. A. Kroessen, (Celebes.)

A common Berok Monkey (*Macacus nemestrinus*).

A pair of Crowned Pigeons (*Goura Victoria*) presented.

An Ibis (*Ibis melanocephalus*) presented by Captain C. E. Remmers.

A young pelican, presented by Tee Gay.

A Monitor Lizard (*Varanus salvator*) caught in Singapore Town, presented by Mr. C. A. Ribeiro.

A tortoise-shell turtle (*Chelone imbricata*) presented by Mr. Klinteberg.

The two fine black storks from Pahang were accidentally killed by a swarm of bees which appear to have stung both birds in the throat.

Upkeep of Buildings, etc.

The most important building work was the erection of a new herbarium and museum building by the Public Works Department. This is an ornamental building 100 feet in length and 28 feet wide, divided into two rooms, one for the herbarium 69 feet in length, and the other 31 feet long for a museum of economic specimens and laboratory. A verandah five feet wide runs round the whole building.

The cost of the whole structure was \$5,926.

A building of this nature has long been required, as the office building was far too small to contain the library and herbarium, both of which have increased so extensively during the last few years, and it was impossible to make a proper collection of our economic products still less to exhibit them, as there was not a corner in which they could be stowed. The transfer of the herbarium from the office buildings will permit of the extension of the overcrowded library shelves, and the proper arrangements of papers and correspondence so as to be easily accessible.

On the site of the old deer-sheds, a small rustic summer house of tembusu posts, walls of split bamboo, and lalang roof was erected with seats inside and a verandah running round it. This has proved very useful as a shelter in rainy weather for people caught in storms at that end of the gardens.

The Cooly-lines, Clerk's quarters and potting shed were re-atapped and four small detached houses were made for married coolies; some of the woodwork of the plant-houses was renewed, but a good deal which required attention could not be done for lack of funds; some of the roads were patched, and one or two of the main drains re-made.

In spite of the labour difficulties and scanty funds, the Gardens were kept in a fairly good and bright condition and were highly admired by many visitors who expressed themselves as quite unprepared for such picturesque gardens.

Plants in Flower.

Among the more interesting plants which flowered in the Botanic Gardens for the first time were:—*Acanthus Montanus*, *Ocimum viride*, the Mosquito plant, *Dracæna phrynioides* and the *Uganda Coreopsis* from Africa. *Diospyros argentea*, *Calamus scipionum*, the Malacca cane, *Parabæa capitata*, *Dendrocolla*, two new species collected by Mr. Machado. *Coscinum fenestratum*, *Raphidophora Korthalsi*, *Mapania triquetra* n.sp. from the Malay Peninsula.

Schismatoglottis multiflora, n.sp. *Curculigo racemosa*, n.sp. *Homalomena fasciata* n.sp. *Haplochorema uniflorum* and *Dracæna au cubæfolia* n.sp. from Borneo. *Alpinia calcarata*, Ceylon, *Dendrobium taurinum var Album*, New Guinea. A new *Strobilanthes* from India, presented by Mr. Micholitz. The *Wistaria* pea, *Dolichos* sp. from Japan.

Zephyranthes citrina, *Chamædorea Martiana*, *Astrocaryum tecumoides*, *Hibiscus lunariifolius*, *Calliandra Caracasana*, *Aphelandra pumila*, *Dichorisandra thyrsiflora*, from South America. A hybrid *Crinum* from Italy also flowered, and *Eugenia braziliensis*, fruited for the first time. This latter is an excellent little sweet black fruit, well worth cultivation.

Plants and seeds received.

The number of plants received during the year by presentation or in exchange was 510 together with 442 packets of seeds.

The donors were Mr. J. C. Harvey (Mexico), Dr. Busse (German East Africa), Mr. Erichsen (Sweden), J. Waterstradt (Borneo), Mr. Micholitz (Burmah and Malay Islands), Bishop Hose (Borneo), Mr. Von Uslar (Borneo Orchids), Mr. St. V. B. Down (Southern Siam plants), Mr. Dupont (seeds of *Lodoicea seychellarum*), Mr. Lyons (Manila), Dr. Abbott (Sumatra), Mr. G. L. Lucas (Jamaica pineapples), Mr. Pritchard (Cotton seed), Messrs. Choa Kim Keat, Chatterjee, Dunman, Wulle Sutton, Harmsen and Boehmer (various ornamental plants), Mr. Machado (Perak plants) and the Conservator of Forests, Darjiling, Southern Californian acclimatization Society, the Botanic Gardens of Kew, Gold Coast, Lagos, Uganda, Barbados, Mysore, Madagascar, Lagos, Calcutta, Sierra Leone, Selangor, British Guiana, Mauritius, Baroda, Sydney, and Dehra Dun.

During a short excursion on leave to Sarawak, I obtained a number of new and interesting Borneo plants.

Plants and seeds sent out.

During the year, exclusive of plants sold, there were sent out 233 plants and 234 packets of seeds.

Among the recipients were, Mr. Choa Kim Keat, Mr. Pereira, Mr. Harvey, Messrs. Dunman, Dr. Busse, Mr. Frizell, Mr. Meissner, Mr. Craddock, Mr. Down, Mr. Bland, M. Boehmer, and Bishop Hose.

The District Officers of Tampin, Kuantan, Kuala Kubu, Temerloh, Kuala Lipis, Raub, District Surgeons of Pekan, Kwala Lipis, Malacca, Province Wellesley, Negri Sembilan, Kwala Lumpur, Teluk Anson, Parit Buntar, Batu Gajah, Taiping, and Conservator of Forests.

The Botanic Gardens of Kew, Uganda, Seychelles, Gold Coast, Madagascar, Zanzibar, British Central Africa, British Guiana, British Honduras, Jamaica, Mauritius, Sierra Leone, Old Calabar, Southern Nigeria, Trinidad, Baroda, Penang, Selangor, Southern California, Acclimatization Society.

The Flora.

The portion of the Flora dealing with the Monocotyledons was finished and the greater part is type written and ready for publication. The *Gesneraceæ* were also finished during the year. The collection of *Utricularias* was loaned to Dr. PRAIN at Calcutta who is undertaking the *Leutibulariæ* for the flora, and he on his part sent the collection of *Gesneraceæ* of the Calcutta herbarium to be studied for the Flora. The herbarium specimens of *Impatiens* were sent on loan to Sir JOSEPH HOOKER at Kew who is writing an account of those of the Indo-Malayan region.

The Artist continued to make drawings of plants for the flora and to finish the unfinished drawings. He however is resigning his post in January. The loss of his services is regrettable in the cause of botanical science, as these drawings are of the

greatest value in a country where specimens of many plants are almost impossible to preserve satisfactorily, and it is the more unfortunate inasmuch as the Malay Artist at Penang, trained carefully in botanical drawing, has also left for a post of an inferior class of work, but higher pay.

The Agricultural Bulletin.

The Bulletin was published regularly each month. It contained 419 pages and nine plates. The Government of the Straits Settlements and the Federated Malay States contributed as before \$600 to its cost. The demand for it increased to nearly double what it was last year, 600 copies being distributed, each month, Nos. 1, 8, 9 and 10 of the first volume being all sold out are being reprinted to supply the demand for them. The old series was also much in request and several numbers have had also to be reprinted.

The Herbarium.

During the year I had little opportunity of getting any collecting expeditions as it was not possible to leave the Gardens while the temporary Assistants were new to the work. But in July I visited Sarawak on leave and taking a plant-collector obtained a large series of herbarium specimens as well as living plants, many of which were new to Science. Herbarium specimens were received in exchange or by presentation from—

Hose, Miss.—Bornean Grasses.

Shelford, Mr. R.—Bornean plants.

Prain, Dr.—Malay Peninsula plants collected by Wray, Scortechini and Kunstler.

Micholitz, Mr.—Borneo plants.

Merrill, Mr.—Philippine plants.

Burn-Murdoch, Mr.—Peninsula plants.

Machado, Mr.—Perak plants.

Barton, Capt. F. R.—New Guinea plants.

Moorhouse, Mr.—Specimens of rattans from Negri Sembilan.

Engler, Dr.—New Guinea plants.

Napier, Mr.—Negri Sembilan plants.

Duplicate specimens were sent to Kew, Calcutta, Berlin and Sydney Gardens and to Mr. Merrill in the Philippines and Dr. Beccari.

Eight new Cabinets for herbarium specimens were made.

The Herbarium is now without doubt the finest for Malay Peninsula plants in the world, and contains many types and cotypes of plants from the Peninsula, Borneo, Sumatra and Siam. Although it is chiefly confined to the local plants it also contains valuable series from the islands of the Malay Archipelago and Australia, and a few from Europe, America and India. Named Garden plants are often added for reference, in identifying cultivated plants.

Library.

The Library has so much increased that the small accommodation it had proved far too small, so that the new building destined for the herbarium was much required, so that the rooms in which the herbarium is packed will be in future available for the extension of the library. Although the money which could be annually offered for the purchase of books has been very limited, the collection is an excellent working one, and several professional botanists have come to study the catalogue, and professed themselves well pleased with the library. A very large number of books and papers are received in exchange for the Gardens Reports and especially the Agricultural Bulletin.

The following books were presented by their respective authors or Governments:—
Nanninga, Dr. A. W. J.—Invloed van den Boden op de Samenstelling van Het Theeblad.

Koningsberger, Dr. J. C.—Ziekten van Ryst Tabak en andere Culturgewassen.

Hunger, Dr. F. W. J.—De Mosaick Ziekte bij Deli.

Hissink, Dr. G. J.—Tabaks Cultur.

Koorders and Valetton—Boomsorten op Java, part 7-9.

De Bie, H. C. H.—De Landbouw der inlandsche Bevolking.

Der Botanischer Garten und die Botanische Museum der Universitat Zurich.

Penzig, O. and Saccardo, P. A.—Diagnoses Fungorum Novorum in Insula Javae, presented by the Authors.

Maiden, J. H.—Eucalyptus tereticornis and E. rostratus.

Notes on some unrecorded plants collected by W. V. Fitzgerald.

Critical revision of the Genus Eucalyptus.

- Maiden, J. H.—Is *Eucalyptus* variable.
 On *Eucalyptus polyanthemus*.
- Fairchild, D. G.—Spanish Almonds and their introduction into America
 Berseem, the great forage crop of the Nile valley.
 Three new plant introduction from Japan. Japanese Bamboos.
 Letters on Agriculture, West Indies, Spain and the Orient.
- Wiley, H. W.—Official Method for analysis of Tanning materials.
- Satow, Sir Ernest.—The cultivation of Bamboos in Japan.
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Receipt and Expenditure.

		\$	c.
By balance in Bank	...	964.01	
Government Grant	...	8,407.00	
By Sale of Plants and Seeds	...	2,562.96	
Interest	...	24.18	
		<hr/>	
Total	...	\$11,958.15	
		<hr/>	

Expenditure.

		\$	c.
Wages of Coolies, &c. ...	...	4,627.	26
Bills ...	...	6,716.	47
Balance, ...	...	614.	42
		<hr/>	
Total ...		\$11,958.	15
		<hr/>	

Economic Gardens.

A considerable tract of land lying along the Cluny Road was felled and stumped to plant Para rubber on it. This land lies between two blocks of Para rubber and had many years ago been planted up with Merbau, Inga Saman, Calophyllum inophyllum, Cedrela Toona, and Mesua ferrea, with a few other trees. The whole had grown into a dense scrub of secondary growth, all of which was cleared out leaving the more valuable trees. The Calophyllum is useless for foresting in this way, and had made little growth, nor were the Inga Saman much better. Owing to the difficulty of getting labour this work was not quite finished by the end of the year.

On the hill behind the policemen's quarters the trees were thinned and Castilloa planted through the wood, and outside along its edge, to compare the growth of this plant with and without shade.

A piece of secondary jungle along the Cluny Road between the cooly lines and the entrance to the lower gardens was thinned and planted through with Gutta percha, *Dichopsis oblongifolia* and also *D. obovata*.

The road from the Dalvey entrance to the main entrance through the garden was widened, strong drain pipes put in the culverts and kept in good condition as a riding road, and has been very popular. Beds were made and planted with Cotton, and a number of new vegetables were cultivated together with several species of *Ocimum* including the mosquito plant, *Ocimum viride*. Experiments made with these especially the last mentioned proved their complete uselessness in driving away Mosquitoes. Ramie beds were renewed and the stock replanted, and a new bed of Patchouli under partial shade was made.

The experiments in manuring Para rubber were continued, the plants being planted out in beds manured with different kinds of manure. The experiments confirmed those made on pot plants in the previous year—those manured with cow-dung making the greatest growth and those with burnt earth and leaves came next, while lime appeared to injure the plant. A number of plants of Para Rubber were manured also with different kinds of phosphate manures, but no very apparent result has yet appeared.

A number of Para Rubber trees well grown were mulched with cut grass, as an experiment but the results of this will not be shown for some time.

The most important experiments were those made by tapping the adult Para rubber trees. Experiments were made as to the best method of cutting the tree with the least injury, in the flow of latex as taken from different heights on the tree, at different times and under different weathers, also as to preparing the rubber from the latex. A quantity of rubber prepared in the Gardens, 143 lbs was sold to various buyers at home who spoke highly of it, and gave an average price of 4 shillings a pound for biscuit and 3 shillings for scrap. Samples of well prepared rubber were given to various planters and others interested in the business and some specimens were sent to the Imperial Institute and to Kew. Latex was supplied to the Government Analyst for examination and analysis.

Experiments were also made in the acidity or alkalinity of all laticiferous trees in the Gardens, by which it was shown that Para rubber latex was unique in possessing a distinctly alkaline latex.

The account of these experiments was published in the Agricultural Bulletin. During the progress of the experiments in tapping a large number of residents, planters, and others came to see the work carried out. During the year 94,235 seeds and 12,454 plants of Para rubber were supplied to planters.

The crop of seed was very irregular this year, probably due to the irregularity of the weather for the past two years. Many of the trees fruited very late, and some apparently not at all.

Probably for similar reasons the fruit crop, especially Durians and Mangosteens, was very short this year.

The chief demands besides Para rubber were for fruit-trees, Vanilla, chocolate, shade trees and pepper plants. There was a large demand from New Guinea, the Seychelles, and the Native States. Pepper was wanted chiefly for Madras where a disease had destroyed a large quantity of the Estates. Mr. G. B. CERRUTI conceived the idea of teaching the Sakais to make Panama hats and a small number of plants was supplied him with instructions as to their use, and a number of plants were planted out to observe their growth.

Vegetable seeds were in demand for Cocos and Christmas Islands and elsewhere.

The stock of economic plants was re-arranged, and a good number propagated to supply demands.

Among the important economic plants added to the Gardens were *Eugenia pitanggo*, a fruit tree from Mexico sent by Mr. HARVEY; a large variety of Guava, from Trinidad Botanic Gardens; a number of Mangos from Madagascar, and some grafted kinds from CHATTERJEE (Calcutta). Cardamum seed from Ceylon; Cotton seed from Egypt, presented by Mr. PRITCHARD (Penang). *Ocimum viride* from Sierra Leone Gardens; eight kinds of pineapple suckers from Mr. LUCAS (Jamaica) and one kind, the Spineless Guatemala pine from Mr. HARVEY of Mexico, and plants of a very large Ceylon variety from Mr. CAREY.

Seed of the fodder grass *Paspaliun dilatatum* was obtained from Australia, but did not germinate.

Vote	...	...	...	...	\$2,808.00
Expenditure	...	...	...	...	2,797.26
					<hr/>
				Balance	\$ 10.74

Government House Grounds.

There was less trouble among the Coolies in the Government House domain than in the Botanic Gardens, and the full number worked all the year. The overseer RAPP worked well.

Vote	...	...	...	...	\$2,266.00
Expenditure	...	...	...	...	2,242.23
					<hr/>
				Balance	\$ 23.77

Inspection of Coconut Trees.

During the year the inspector visited all the plantations of Coconut trees in Singapore and served notices on 222 persons to destroy 925 dead trees, and remove or destroy 57 piles of rubbish. All complied with their notices and there were no prosecutions.

Although a few beetles occur in Singapore still, the amount of damage done is really very small.

Vote	...	...	...	...	\$210.00
					<hr/>
Transport	...	...	...	...	181.58
Uniform	...	...	...	...	8.00
Balance	...	...	...	...	20.42
					<hr/>
					\$210.00

HENRY N. RIDLEY.

Director of Gardens.

Botanic Gardens, Penang.

The year 1903 will long be remembered as the one in which the designer of the Gardens had to retire owing, I regret to say, to ill health. Mr. CURTIS had arranged to go on long leave in April, but a complete breakdown in February necessitated his departure for England on March 7th. In Mr. CURTIS'S retirement the Government lose an able conscientious and hardworking officer. It falls to the lot of few men on their retirement to leave their life's work in so visible and concrete a form.

Eighteen years ago the site of the present beautiful Gardens was practically waste ground. It is now the pride of the Colony and the admiration of all who visit it. I took over charge of the Department on March the 24th as Acting Superintendent, and was appointed to the substantive post on December 7th, the date of Mr. CURTIS's retirement.

2. *The Weather*.—The year has been remarkable for the unequal distribution of the rainfall. Up to August the rainfall was far below the average, since then however the fall has been heavy, and prolonged more than usual. The total fall of the year was on Government Hill 125·93 and on the plain 103·76 inches.

3. The work of the year must I fear be considered not what it should have been as regards new work, owing to the uncertainty which still hangs over us, as regards the possible requirements of the Garden Valley as a site for a new water reservoir. On the other hand more time and attention has been given to the upkeep of the collections and the neat and tidy appearance of the Garden in detail work. As pointed out in last year's Report this uncertainty has a paralysing effect. Several projected improvements are hung up in consequence and it will be a great relief when we know definitely one way or the other what is going to happen. I have already reported to Government my views on the matter in case the Garden site is required.

4. The flower beds and shrubberies have been attended to and heavily manured, and otherwise maintained in good order by replanting where necessary. With the view of having possibly to change our site, I have paid more than the usual attention to propagation, so that our stock will be easily transferred in case we do move, many specimens being kept in tubs, which ordinarily would have been planted out.

The large Iron Plant House.—This has been thoroughly overhauled and replanted, and I have taken advantage of the many alpine plants such as *Didymocarpi*, *Bacca* etc., which Mr. CURTIS had collected to plant up the rockeries with them which suits them much better than being kept in pots.

5. *The Orchid House*.—This is always an attraction to visitors and rarely is it that there are not in flower such things as *Cattleyas*, *Laelias* or *Oncidiums*. The *Calanthes* have not done so well this year owing to the attack of a fungus which despite spraying did them a certain amount of harm and rendered them less floriferous than usual. The *Habenarias* were however particularly good.

6. The usual potting of the other pot plants was done during the year and special attention was given to flowering plants of all sorts.

7. The principal contributors and recipients of plants and seeds were practically those of other years. Plants to the value of \$894 were sold during the year, the whole being plants of a decorative character of which there is a steady demand not only in Penang, but in the Native States, Sumatra, etc.

8. *Governor's Hill Bungalow Gardens*.—

These were kept up in as good order as possible with the means at command. I am glad to say that the Government have slightly increased the Vote for next year, which will enable them to be kept up as they should be.

9. *Herbarium and Library*.—

No botanical tours were made during the year, owing partly to my time being spent on Forest work and partly to the fact that the weather was too boisterous to visit the Langkawis at a time when it was convenient for me to do so. The following Natural Orders *Gesneriaceae* and *Aroidae* have been sent to Singapore on loan for the use of the Director in connection with the preparation of a part of the "Materials for a flora of the Malayan Peninsula" he is preparing. The usual work of mounting and intercalating of specimens has gone on as usual. I regret to say that owing to the resignation of the artist MOHD: HUSSAIN about the middle of the year fewer drawings have been made than usual. I am endeavouring to replace him by training another man this, however, necessarily takes a long time.

10. *Economic Plants*.—The Para Rubber Tree which has so often been spoken of in previous Reports, was again tapped on 15 occasions and gave a daily return of from 1½ oz. to 17¼ ounces. The total tappings for the year amounted to 3 lbs. 6 oz. and the grand total to 22 lbs. 15 oz.

11. *Cotton*.—Perhaps no Agricultural Product has had so much attention given to it all over the world during the year as Cotton. This is of course due to the shortage of crops in America which has had such disastrous effects on the Cotton industry of Lancashire. The subject so far as it affects this part of the world is discussed in the Agricultural Bulletin at some length by the editor and Messrs. BAXENDALE and ARDEN, but unfortunately there are very few reliable data to go upon. The experi-

ments throughout India however with the finer long staple cottons like the Sea Island variety has been, I regret to say, unsatisfactory. Through the kindness of Messrs. PRITCHARD & Co. a small parcel of Egyptian cotton seed was imported by them and distributed to several planters and others. The plants raised from seeds supplied us have been planted on one of the Estates in the Province where they will have a better chance of showing how far they are adapted for growing in the country, than had they been kept in the Gardens. The results will be duly noted. Another of our local Planters has determined to give Sea Island Cotton an exhaustive trial in this country and for this purpose he has asked me to procure for him two Cwt. of the best strain of Sea Island Cotton Seeds. We shall therefore be in a position to tell whether Cotton will be one of the staple cultivations to be added to our list of Agricultural products introduced from America.

12. *Gutta Percha*.—Our seed bearing trees which fruited in 1901, have shown no sign of flowering again.

13. *Coco-nut trees Preservation*.

The number of summonses issued was 103 and fines were recovered to the amount of \$249.50 as against 44 summonses and \$101.50 fines recovered in 1902. A sharp look out was kept over the "Roko" (Cigarette paper) makers in the Province, as it was found that the black beetle was particularly fond of depositing its eggs in the refuse of the Nipah leaves, which form the outer covering of Rokos. The following Table summarizes the work done during the year. The Expenditure being shown in Appendix A.

14. *Expenditure*.—The total amount of Government Grants under the heading of Botanic Gardens amount to \$7,000, of which \$6,868.27 was expended, particulars of which are given in Appendix A annexed.

W. FOX,
Superintendent.

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District	198	1,649	202	153	340	21	\$ c. 51 50	
Province Wellesley, Central District	285	1 045	203	102	251	15	22 50	
Province Wellesley, Southern District	106	697	95	80	130	9	22 50	
Penang Island.	493	2,701	414	121	635	58	153 00	
Total.	1,082	6,074	914	456	1,356	103	249 50	

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1903.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant—		{ Wages	3,197 97
Maintenance of Water- fall Garden ...	4,960 00	{ Stores, Tools and Material ...	125 40
		{ Pots and Tubs	294 69
		{ Manure and Cartage	68 80
		{ Freights	45 07
		{ Office Furniture	12 00
		{ Chicks for Plant Sheds	52 31
		{ Miscellaneous & Petty Expenses	1,094 64
			4,890 88
		Balance	69 12
		Total	4,960 00
Government Grant—		{ Wages	1,073 27
Upkeep of Grounds of Governor's Hill Bungalow	1,180 00	{ Tools and Attaps	32 85
		{ Manure	30 37
		{ Flower Pots	21 00
		{ Petty Expenses	2 47
			1,159 96
		Balance	20 04
		Total	1,180 00
Government Grant—		{ Wages	42 00
Reafforesting Site of Ex- perimental Nursery ...	50 00	{ Balance	8 00
			50 00
		Total	50 00
Government Grant—		{ Pony Allowance	228 39
Travelling and Personal Allowance	440 00	{ Passages, Personal and Field Al- lowance	183 79
			412 18
		Balance	27 82
		Total	440 00
Government Grant—		{ Allowance to Inspector of Coco- nut trees	240 00
Expenses of carrying out Provision of Coco-nut trees	270 00	{ Destruction of dead Coconut trees	26 26
			266 26
		Balance	3 74
		Total	270 00
Government Grant—		{ Books and Periodicals	96 99
Purchase of Book and Periodicals	100 00	{ Balance	3 01
			100 00
	7,000 00	Total	100 00
Revenue from Plant Sales	\$ 894 80		
" Swimming Bath	8 90		
" Unserviceable Stores	7 64		
Total collected	\$ 911 34		

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS

SINGAPORE AND PENANG,

FOR THE YEAR

1904

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.



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1905

Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1904.

Staff.

Mr. R. DERRY returned to the East in January, 1904, and immediately took up the appointment of Assistant Superintendent.

The Foreman-Gardener of the Economic Gardens, EZEKIEL, left in October to succeed RAPPa at the Government House Domain, and was succeeded by JOSEPH BENJAMIN who left in two months and a half to take up a post in the Tramways at nearly double the salary.

The constant changes in the posts of Overseers and Foreman-Gardeners during the past few years are detrimental to the progress of the Gardens.

For the work of a Foreman-Gardener some training is necessary even if they have had to manage coolies before, which is rarely the case. This training takes a great deal of time on the part of the Director or his Assistant, all of which is wasted when the man leaves to take up an outside job where his experience is useless, and for his first year or so he is not usually capable of keeping the coolies steadily at work, looking after the tools, stores, or plants, so that this constant change of men not only entails a good deal of extra work, but often an absolute loss, in work done, and tools and stores preserved.

The cooly supply improved during the year and a somewhat better class of men was procurable and in sufficient quantity. There was no sickness of any importance. The watchmen gave no trouble and prevented a good many petty thefts.

Visitors.

The number of visitors to the Gardens showed no diminution, and on the occasions when the regimental band played on moonlight nights there was usually a good attendance. Among the scientific visitors who visited the Gardens during the year were Mr. H. C. PEARSON (Editor of the India-Rubber World, New York), HERR ERNST STIEGEL (Berlin), M. O. COLLET, Dr. HALLIER, Dr. A. K. SCHINDLER (Professor of Natural Science, Pekin), COUNT DE KERGARION (Paris), M. C. & G. DE GINGUE, Dr. PET (Buitenzorg), Staff Surgeon C. G. MATHEW, Mr. G. W. KOEG (The Hague), Mr. T. B. BLOW (Japan), Mr. L. P. RICHMOND (Manila), Dr. DETMER (Jena).

Thefts.

There were no thefts of any importance during the year, a few flowers only being now and then gathered chiefly by passengers. There was one prosecution for flower stealing, and a fine of five dollars was inflicted.

Aviaries.

The only animals added to the Gardens' Aviaries during the year were a specimen of *Attagen minor*, purchased, and a Javanese musang presented. One musang and a crowned pigeon died. The funds of the Gardens not being adequate to keep even the small number of mammals and birds left, it is proposed to dispose of them as soon as possible.

It is regrettable that this necessity has arisen, as the animals were the most attractive part of the Gardens to visitors, and usually the first enquiry of a visitor is, "Where is the menagerie?" A number of animals offered to the Gardens were refused.

Buildings and Upkeep.

The new building, for the Herbarium and Museum, was furnished as far as funds would permit, but more cases are much required, and the specimens of timbers, fibres,

damars and other economic exhibits transferred there with part of the Herbarium. Unfortunately this work could not be continued as the building was very damp and the roof leaked very badly. The old glass house was pulled down as all the wood work was rotten and the rebuilding of it commenced, but had to be stopped for want of funds. In the orchid house the coral-rock tables were reduced in height and repaired, and the building turned into a flower-house or conservatory and kept very bright throughout the year with orchids and flowering shrubs and herbs, proving very attractive to the public.

A number of the drains were rebricked and repaired, but a good deal more is requisite in this work. The remaining mud-drains should be all bricked, especially those round the band-stand, but funds do not permit of this. Considerable difficulty was experienced in getting an efficient mason for the available funds and indeed neither of the two employed were found to be at all satisfactory and had to be discharged.

The long road up to the band-stand and the road to Rogie through the Garden's jungle were remetalled completely and many of the other roads repaired or patched.

A brick wall with iron railings was erected from the main entrance to the Office entrance by the Public Works Department, which is a great improvement.

At the request of the Municipality, a band of jungle along the Tyersall Road was cleared away for a width of 15 feet and a length of four hundred yards, so as to open up this road, and the angle opposite Tyersall entrance was widened.

A number of the Garden seats were repaired or remade and more are nearly finished.

The plants in the large plant-house were re-arranged and many were re-potted, and others replaced by finer specimens. At one end of the house a collection of economic plants was arranged to show the various plants used for the production of rubbers, fibres, spices, etc. Opposite these were arranged a complete set of *Dracænas* and *Cordylines* and on the sides series of *Dieffenbachias*, *Aglaonemas* and *Cyclanthaceæ*. One block was filled with *Anthuriums*, *Philodendrons* and *Alocasias*; another contains ferns, among which are chiefly noticeable splendid plants of *Stenoloma chinensis*, *Asplenium scandens* and *Brainea insignis* with many other rare and curious species. The *Selaginellas* occupy one side of the house, and a very complete collection of *Crotons* is arranged at one end. The *Bromeliads*, *Pandani*, *Cycadææ*, and *Coniferæ* are all grouped in different parts of the house. A very complete series of palms including many very rare species fills one side block. All these plants are well spaced and not overcrowded so that they can be well seen.

A series of tuberous rooted *Begonias* was purchased, and some of them flowered well and lasted a long time in bloom, but the dealer who supplied them would perhaps have done better to supply commoner kinds than the high-class strains received, as these plants are not easy to grow here.

A number of *Caladium* bulbs were also purchased and there was a good show of them. Some very fine strains of *Begonia* were presented by Mr. SANDER, but unfortunately were sent by the ship *Malacca* which was seized by the Russians, and when the plants were at length obtained most were dead.

The flower beds were well manured all over the Gardens, and the nursery beds dug deeply over and manured, and the result was a fine display of herbaceous and half shrubby plants through the year in spite of the drought. Some ornamental water lilies were received from Kew Gardens, and were planted in the lake in baskets being gradually moved into deeper water as they grew stronger. Many commenced flowering very soon and make an attractive display especially in the early morning.

The island on the lake was thoroughly cleared of the large bushes of *Wormia* and masses of *Flagellaria* so as to show up the magnificent plants of *Pandanus Kaida*, *Oncosperma* and rattans, the ground beneath was turfed and some *Bougainvilleas* and *Arundo Donax variegata* planted to give a touch of colour.

All the lakes were cleared of weeds, a work that took some time as the rapidity of growth of *Enhydris*, *Utricularia exoleta* and *Blyxa*, produced an enormous mass of vegetation in a very short period.

The small wood at the upper end of the lake was thinned out, and the clearing of the rockery behind commenced, but this work remains to be finished in 1905.

The extremely dry weather for a considerable portion of the year, entailed a great deal of work in watering, and for this purpose it was necessary to employ water-carts at a considerable expense to convey water from the lake to the plant-house. A scheme for laying in water by pipes from a Municipal main was submitted to Government, but was not proceeded with.

A small portable spraying machine was obtained during the year, and found to be very effective, the insecticide known as Xlall, a preparation of Nicotine, being used. When funds permit it is proposed to get a larger machine for cleaning the trees and shrubs of blight and caterpillars.

New Plants.

The following plants flowered in the Botanic Gardens for the first time :—

Malayan—*Pandanus bicornis*, Ridl.—(Perak).

Pinanga acaulis, n. sp.—(Perak).

Gastrochilus plicatus, Ridl.—(Kelantan).

G. reticosa, Ridl. and *G. minima*, Ridl.—(Borneo).

Schizmatoglottis longispatha—(Borneo).

Acriopsis borneensis, Ridl.—(Borneo).

Caelogyne patens, Ridl.—(Perak).

Duabanga sonneratioides.—(Perak).

Burbridgea nitida, Br.—(Borneo).

Arisaema anomalum.—(Perak.)

Campandra angustifolia, Ridl.—(Borneo).

Didymocarpus rugosus, Ridl.—(Kelantan).

D. crinitus, var.—(Kelantan).

Crinum Northianum—(Borneo).

Cryptocoryne ciliaris—(Borneo).

Palaquium, sp.—(Malacca).

Clerodendron Bethunianum.—(Borneo).

Cypripedium Chamberlainianum.—(Malay Islands).

Dipodium paludosum.—(Borneo).

Siamese :—*Pentacme siamensis*.

Chinese :—*Sagittaria sagittifolia*, var.

Indian :—*Congea tomentosa*, var. *azurea*.

Bauhinia Vahlia.

Vanda Amesiana.

Rubia cordifolia.

Celsia coromandeliana.

Hibiscus radiatus.

Porana paniculata.

African :—*Lantana salviaefolia*.

Cyanastrum, new white flowered species.

Dracæna Godseffiana and *D. fragrans*, *Tinnæa Sacleuxii*.

Tephrosia Vogelii, *Aglaonema Mannii*, *Aristolochia Goldieana*.

Strophanthus longicaudatus.

South America :—

Xanthosoma Lindenii, *Lucuma multiflora*, *Gustavia gracilis*, *Arauja grandiflora*, *Hymenocallis*, sp. *Oncidium tigrinum*, *O. varicosum*, var. *Rogersi*, *Cattleya Harrisoniæ*, *Hibiscus*, 2 species undetermined from Mexico.

Localities unknown :—

Oxalis, sp. red flowers received from Sweden, *Heptapleurum stelznerianum*, *Mucuna sericea*, *Aristolochia Forkelii* (from Kew).

At the end of the year there was a fine show of Burmese dendrobiums, chiefly *Dendrobium crassinode*, *D. primulinum*, and *D. densiflorum*, in the Plant-house.

Plants and Seeds Received.

The number of plants received during the year by presentation was 189 together with 549 packages of seeds.

The donors were Mr. T. B. BLOW (Japanese Seeds); Mr. J. C. HARVEY (Mexico); Messrs. SANDER & Co.; Royal Gardens, Kew; Botanic Gardens, Ceylon; Messrs. DAMMAN & Co.; Mr. ROBERTSON (Australia); Deputy Conservator of Forests, Thaiping; Mr. A. D. MACHADO; Messrs. VEITCH; Mr. EGERTON; Mr. ERICHSON (Denmark); Mr. MICHOLITZ; LADY CROFT; Messrs. HERB (Naples); Mr. CHOA KIM KEAT; Mr. St. V. B. DOWN (Siamese plants); Right Reverend Bishop HOSE; Mr. A. B. LAKE (Selangor); Mr. G. T. GEBEL (Javanese Orchids); Mr. VAN USLAR (Borneo Orchids); Hon. F. G. PENNEY; Herr GIRSCHNER (Governor of the Caroline Islands); and the Botanical Gardens of Porto Rico, Port Darwin, Mauritius, Seychelles, Calcutta, Jamaica, British Guiana, Uganda, Udaipur, Montserrat, Trinidad, Philippines, Natal, Penang, Rangoon, Sydney, Harvard University, Madagascar, Melbourne, Saharanpur, Alipur, and the Department of Agriculture in India (three varieties of cotton seeds).

A number of plants and seeds were also added from the expeditions of the Director to Christmas Island and various parts of the Peninsula.

Seeds and Plants Distributed.

Exclusive of seeds and plants of Para rubber, there were 493 plants and 79 packets of seeds distributed to various private people and gardens in exchange.

The recipients were Mr. J. D'A. PEREIRA, Mr. A. M. BURN-MURDOCH, Mr. J. VEITCH, Messrs. SANDER & Co., Mr. A. D. MACHADO, Mr. ERICHSON, Mr. St. V. B. DOWN, Mr. LUCAS (Jamaica), Right Reverend Bishop HOSE, and the Botanical Gardens and Institutions of Manila, Kew, Hongkong, Penang, Saigon, Selangor, and Buitenzorg.

Herbarium.

Part of the Herbarium was moved to the new building, so as to leave more space in the old office for the Library which was much overcrowded, and six more new cabinets were made.

The following specimens were added:—

Rt. Rev. Bishop HOSE—Bornean grasses and sedges.

Dr. GIMLETTE—Plants from Kuala Lebir, Kelantan.

Dr. E. MERRILL—Scitamineæ of the Philippine Islands.

Royal Gardens, Calcutta—29 specimens of Pandanus, and a number of Rubiaceæ, etc., from the Malay Peninsula, collected by WRAY, KUNSTLER and SCORTECHINI.

Royal Gardens, Kew—37 orchids and balsams, from India.

Mr. A. M. BURN-MURDOCH—Specimens of timber trees chiefly Dipterocarpeæ from Selangor.

A large series of plants was also collected by myself in the Semangko Pass and at Rantau Panjang in August, and also in Perak and elsewhere in February, and a good series of plants was also collected in Christmas Island during a Government expedition in October.

At the end of December, I went on leave to Gunong Pulai, in Johore, and collected a good number of plants in the week spent there.

In the small part of the new building destined for a Museum, a number of specimens were cleaned, sorted and arranged, and as many new cases as could be afforded were obtained. The COLLINS collection of resins, gums, fruit seeds, etc., was arranged in glass-topped boxes. A large series of rattans, resins, Dragon's blood and other specimens of economic importance were obtained at the Agricultural Exhibition held in Kuala Lumpur. Timber specimens were sent by Mr. HUDSON and Mr. MOORHOUSE from Seremban, and specimens of the timbers of Christmas Island were also added to the collection. A fine series of Gutta perchas was presented to Museum by Mr. POBLOTH, and a fine series of fibres prepared by Mr. C. J. SCHIRMER, chiefly from plants grown in the Botanic Gardens and decorticated by his new machine.

Duplicate Herbarium specimens were sent to Kew (538), Berlin (314), Manila (241), and the British Museum (153).

A series of large timber specimens partly obtained by Mr. BURN-MURDOCH and partly obtained in Singapore were forwarded to the Imperial Institute.

Specimens of the Ngai camphor with a large quantity of the dried leaves for analysis were sent to the Botanic Gardens, Buitenzorg, and a quantity of bat-guano from Perak was sent to the Imperial Institute for investigation.

Library.

The following books and pamphlets were presented to the Botanic Gardens Library during the year:—

Veitch, J. B.—Some lesser-known Japanese trees and shrubs, by the author.

Sargent, C. S.—Synopsis of the genus *Lonicera*.

New or little known North American Trees.

Cratægus in North Eastern Illinois.

Cratægus in Rochester, N. Y.

Recently recognized species of *Cratægus*.

Notes on a collection of *Cratægus* by the author.

Wildeman, E. de.—Flora of the Congo (continued) by the Belgian Government.

Rehlig, C.—Berichte über Land und Forstwirtschaft in Deutschland, by the author.

Busse Walter.—Ueber den Rost der *Sorghum* Hirse in Deutsch Ost Africa, by the author.

Head, B.—The food of the Gods, by C. N. Harris.

Creosoting Co.—Creosoted Timber.

Dundon, P. T.—Paget Sound Timber Preserving Company, by Dr. Von Schrenk.

Lloyd, G. G.—Mycological Notes, by the author.

Massart, J.—Notice sur les collections Ethnologiques, by the author.

Christ, Dr. H.—Zur Farn-Flora Von Cèlebes, by the author.

Loxsomopsis costaricensis, by the author.

Macoun, J.—Catalogue of Canadian Plants (continued), by the author.

Pardy, A.—Manures in the Natal Market for the Seasons 1902-1903, by the author.

Subba Rao, C. K.—Sugar cane Cultivation in the Deccan, by the Madras Government.

Usteri, A.—Beobachtungen über tropische Märkte, by the author.

Woodrow, Marshall G.—The Mango, by the author.

Power, F. B. and Less, F. H.—Chemical Examination of Kosam seeds, by the authors.

Cook, Thw.—Flora of the Presidency of Bombay, Vol. II., part I.

Medley-Wood.—Natal Plants, Vol. II. part I, presented by the Natal Government.

Costerus, J. C. and Smith, J. J.—Studies in Tropical Teratology, presented by authors.

Van Eeden, Houtsoorten—presented by Mr. Van den Son.

Peredes, P. E. F.—Comparative Anatomy of the barks of the Salicaceæ, presented by author.

Koningsberger, Dr. J. C.—Tripang en Tripang Vischerei, presented by the Botanic Gardens, Buitenzorg.

Hissink, D. J.—Bemesting's proeven en omtrent grond analyses, presented by the Botanic Gardens, Buitenzorg.

Hazewinkel, J. and Wilbrink, G.—Onderzoekingen aan het Proefstation voor Indigo, presented by the Botanic Gardens, Buitenzorg.

Mohr, Dr. Julius—Over Beslag op Deli Tabak, presented by the Botanic Gardens, Buitenzorg.

Mohr, Dr. Moet.—de Deli Tabak-oogst Geplukt op Gesneden Worden, presented by the Botanic Gardens, Buitenzorg.

Mohr, Dr.—Over Tabaksasch als Meststoff, presented by the Botanic Gardens, Buitenzorg.

Hunger, Dr. F. H. J.—Invloed van het verspenen van Tabak's bibit, presented by the Botanic Gardens, Buitenzorg.

Hunger, Dr. F. H. J. Physiologische onderzoekingen over Deli-Tabak, presented by the Botanic Gardens, Buitenzorg.

Hunger, Dr. F. H. J.—Statistiek over den Regenval der Sumatra's oostkuste, presented by the Botanic Gardens, Buitenzorg.

- Tromp de Haas, Dr. W. R.—Over de Cultuur van *Ficus elastica*, presented by the Botanic Gardens, Buitenzorg.
- Tromp de Haas, Dr. W. R.—Jute Cultuur.
- Breda de Haan, Dr. J.—Wortel-ziekte Bij de Peper op Java, presented by the Botanic Gardens, Buitenzorg.
- De Vriens, J. C.—Over Samengesteide en Enkelvoudige Meststoffen, presented by the Botanic Gardens, Buitenzorg.
- Van Hall, Dr. C. J. J.—Inspectie van den Landbouw in West-Indie, presented by the Botanic Gardens, Buitenzorg.
- Koningsberger, Dr. J. C.—Ziekten in Klapperaan plantingen, presented by the Botanic Gardens, Buitenzorg.
- Van Dine, D. L.—Insecticides for use in Hawaii, presented by the United States (America) Government.
- Van Dine, D. L.—A Sugar cane Leaf Hopper, presented by the United States (America) Government.
- Van Dine, D. L.—Mosquitoes in Hawaii, presented by the United States (America) Government.
- Newell, F. H.—Irrigation, presented by the United States (America) Government.
- Pinchot, G. and Merriam, G. H.—Forest Destruction, presented by the United States (America) Government.
- Sternberg, Dr. G. M.—Transmission of yellow fever by Mosquitoes, presented by the United States (America) Government.
- Sternberg, Dr. G. M.—Malaria, presented by the United States (America) Government.
- Haviland, G. D.—Observations on termites (Reprint), presented by the United States (America) Government.
- Brandt, K.—Life in the ocean, presented by the United States (America) Government.
- Oorsey, C. W. L. Mesner and Caine, T. A.—Soil Survey from Arecibo to Ponce, Porto Rico, presented by the United States (America) Government.
- Loew, O.—A New Enzyme of general occurrence, presented by the United States (America) Government.
- Howard, L. O.—The Economic Status of Insects as a class, presented by the United States (America) Government.
- Baum, H. E.—The Bread-fruit, presented by the United States (America) Government.
- Koorders, F. H. and Valetton Th.—Additamenta ad cognitionem Floræ arboreæ Javanicæ, presented by the Buitenzorg Gardens.
- Van Leenhoff, T. W.—Coffee Planting in Porto Rico, presented by the United States (America) Government.
- Musgrave, W. E. and Clegg, M. T.—Amœbas, presented by the United States (America) Government.
- Wilcox, E. M.—The Mexican Cotton—Boll Weevil, presented by the United States (America) Government.
- Shaw, G. R.—The Pines of Cuba, presented by the United States (America) Government.
- Edwards, H. T.—Magney in the Philippines, presented by the United States (America) Government.
- MacDill, Dr. J. R. and Wherry, Dr. W. S.—Two Cases of a peculiar hand infection, presented by the United States (America) Government.
- Woolley, P. J. and Jobling, J. H.—Hæmorrhagia septicoemia in animals, presented by the United States (America) Government.
- Woolley, P. J. and Jobling, J. H.—Pulmonary lesions produced in Carabaos.
- Merrill, E. D.—Dictionary of Philippine Plant Names, presented by the United States (America) Government.
- Merrill, E. D.—New or Noteworthy Philippine Plants, presented by the United States (America) Government.
- Woolley, P. J.—Texas fever in Philippines, presented by the United States (America) Government.

Woolley, P. J.—Report on *Bacillus Violaceus*, presented by the United States (America) Government.

Herzog, Dr. M.—A fatal infection by *Bacillus aureus foetidus*, presented by the United States (America) Government.

Herzog, Dr. M.—Forest Manual of the Philippine Islands, presented by the United States (America) Government.

King, Sir George.—Materials for a Flora of the Malay Peninsula (continued).

The following books were purchased :—

Lignum Aloes by Prof. Dr. J. Moeller.

Genera Aroidearum by H. Schott.

Colonial Reports on Seychelles.

Engler's Pflanzenreich (continuation).

Nicholson's Dictionary of Gardening (supplement).

Index Kewensis (supplement).

Weber's Chemistry of Rubber.

Nicholson's Tropical Agriculturist.

King's Text Book of Physics of Agriculture.

Journal of the Linnean Society.

Botanical Magazine.

Gardener's Chronicle.

Indian Gardening and Planting.

India-Rubber Journal.

Tropical Agriculturist.

The following journals, etc., have been presented by their respective Institutions:—

Jamaica Bulletin, Dominica Agriculturist, Journal of the Department of Agriculture, West Australia, Bulletin du Jardin Botanique (Brussels), Annual Report of the Forest Department of Australia, Acti Horti Petropolitani, Planting Opinion, Indian Forester, Pharmaceutical Review, Chemist and Druggist, Journal D' Agriculture Tropicale, Agricultural News of the West Indies, Journal of the Board of Agriculture, Revue des Cultures Coloniales, Bulletin de la Société d'Etudes Coloniales, Bulletin Economique de Madagascar, Agricultural Journal of the Cape of Good Hope, Bulletin Economique de l'Indo-Chine, Bulletin Economique de Hanoi, Trinidad Bulletin, Report on the Agricultural Work in British Guiana, Report of the Board of Agriculture, British Guiana, United States Experimental Station Records, Udaipur Garden Report, Icones Bogorienses, Technical Reports of the Imperial Institute, Hawaii Bulletin, Barbados Garden Report, Jamaica Garden Report, Trivandrum Garden Report, Transvaal Agricultural Journal, India Rubber World, Kew Bulletin (Appendix), West Indian Bulletin, Smithsonian Institution Report, Missouri Garden Report, Ceylon Garden Report, Natal Garden Report, Hongkong Garden Report, Saharanpur Garden Report, Tobago Botanic Station Report, Proceedings of the Agri-Horticultural Society of Madras, Records of the Botanical Survey of India, Trade and Commerce Report of Canada, Porto Rico Garden Report, Report on Indian Museum, Grenada Garden Report, Uganda Garden Report, New York Bulletin, Madras Forest Department Annual Report, Ceylon Circulars, Merck's Annual Report, Agricultural Ledgers, Bulletin de l'Institut Botanique de Buitenzorg, Queensland Agricultural Journal, Calcutta Garden Report, Report of Calcutta Cinchona Plantations, Bulletin of the Koloniaal Museum of Haarlem, Der Tropenpflanzer, Annales du Musée du Congo, Meteorological Observations of Zomba, Annual Garden Reports of the Botanic Gardens, Gold Coast, Lagos, Zanzibar, Sierra Leone, Seychelles, Mauritius, Mysore, Lucknow, Buitenzorg, Fiji, New South Wales, Adelaide, Brisbane, Melbourne, British Honduras, Antigua and Bermuda.

Publications.

The account of the Gesneraceae of the Malay Peninsula for the Flora was completed and is being published in the Journal of the Asiatic Society, Straits Branch, and papers on new plants of the Peninsula and of the surrounding countries were also published therein during the year. Many of these plants are in cultivation in the Botanic Gardens. The Artist continued to make drawings of plants suitable for publication in the Flora.

The Agricultural Bulletin was published monthly, and continues to be in good demand. The circulation has risen from 250 copies to 600. Several numbers of previous years having been sold out were reprinted.

In one number a list of the palms cultivated in the Botanic Gardens, 236 in number, was published with directions for cultivation. The list has been widely distributed to various gardens and establishments for exchange purposes. Since its publication several more palms including the new *Pinanga acaulis* and *Borassus Machadonis* have been added to the Gardens' collection which now numbers over 240 kinds.

Receipts and Expenditure of the Botanic Gardens, Singapore, for the year 1904.

				\$	c.
By balance in Bank	...	...	...	614	42
Government Grant	...	...	...	11,000	00
By sale of Plants and Seeds	...	...	...	4,779	41
				<hr/>	
				16,393	83

				\$	c.
EXPENDITURE.					
Salaries	...	...	...	6,190	90
Bills	...	...	...	9,624	78
Balance	...	...	...	578	15
				<hr/>	
				16,393	83

Economic Gardens.

A portion of the swampy low-lying ground along the Cluny Road which was partly cleared and stumped last year was finished and planted with Para rubber. Another large patch of ground formerly covered with scrub and Sago palms, was cleared and dug and planted with *Sansevieria zeylanica*, *S. guineensis*, *S. cylindrica* and *S. Kirkii*, together with *Fourcroya gigantea* and *Musa textilis*.

There has lately been a demand for these fibre plants, which it is hoped may be extensively planted as a catch crop for Para rubber. An exhibition of fibres prepared by Mr. SCHIRMER, at the Agricultural Exhibition in Kuala Lumpur, which attracted much attention, was prepared largely from fibres grown in the Botanic Gardens. Among the fibres thus exhibited were several different kinds of *Sansevieria*, *Yucca*, *Agave americana*, *Fourcroya gigantea*, *Karatas Plumieri*, *Pandanus Kaida*, Pine-apple and Ramie.

Experiments were made in the different methods of propagating *Sansevieras* by leaf-cuttings.

The Ramie beds were re-dug and a fresh stock planted.

The cultivation of fibres in the Malay Peninsula has been too much neglected but it bids fair to occupy a more important position in the future.

Cotton.—Owing to the urgency of cotton cultivation throughout the empire further attempts to cultivate cotton of various kinds under different circumstances were made. One hundred and nine varieties of cotton seed were received from the Director of Agriculture of India and three varieties from Jamaica, and one from Kew. The climate and soil of Singapore seems, however, quite unsuited for cotton culture, owing to the excess of rain, and the red-cotton bug, *Dysdercus cingulatus*, in spite of the use of insecticides destroyed nearly all the pods.

Among other important economic plants introduced during the year was a set of fifteen kinds of *Sansevieria* received from Kew Gardens, some of which have too small leaves to be of use for fibre extraction, but several will probably prove valuable additions to the stock of fibre plants suited for cultivation on a large scale here.

Carludovica Jamaicensis, the Ippe-appi, much used in Jamaica for making Panama hats and other such fabrics was obtained from Jamaica and is growing well. The true Panama hat plant *Carludovica palmata*, of which a number of plants were planted out experimentally last year, have not grown as rapidly as might have been expected.

Seeds of the Caroline Islands Ivory-nut palm, *Caelococcus carolinensis*, were received from the Governor of the Caroline Islands, and an additional supply of the Amazons Ivory-nut palm, *Phytelephas macrocarpa*, from Trinidad. The only plants of the latter in the Botanic Gardens which have flowered as yet are all males. It is hoped that some females will be among the newer stock.

Suckers of the Porto Rico pineapple were sent by Mr. J. C. HARVEY, a new kind of pine for the East, and from the same correspondent was received the little wild Tomato of South America, with fruits as big as a cherry, forming a very pleasant fruit, and being a very prolific bearer.

Brucea sumatrana, "Kosam."—A quantity of the seeds of this plant, 24 lbs. in weight, was sent to Messrs. BURROUGHS and WELCOME, whose research-chemists Messrs. F. B. POWER and F. H. LEES published a very valuable paper on the subject. No alkaloid was found but two bitter principles were isolated, neither of which was quassin, as stated by other chemists, "a correct conclusion respecting the active principle of Kosam seeds could apparently only be formed when some definite constituent of them such as the bitter principle (α) isolated by us, is treated clinically with reference to its particular value in the treatment of dysentery."

This, it may be hoped, will be done; meantime further reports as to the efficacy of the seeds have been received in correspondence at the Botanic Gardens.

Paspalum dilatatum.—The Australian Fodder Grass was successfully introduced and grew well, being readily propagated by breaking up the clumps. *Tricholæna rosea* however failed again.

Exclusive of Rubber seeds and plant the chief demand was for Cotton, Nutmegs, Sago, *Brucea sumatrana*, fruit trees, and *Sansevieria*.

Para Rubber.

The demand for plants and seeds of *Hevea brasiliensis* showed no falling off, indeed it was quite impossible to supply anything like the demand. Of seeds 170,175 and of plants 28,665 were disposed of during the year.

As the seed crop was rather irregular this year the grass and weeds had to be cleared beneath the trees for the purpose of collecting them several times which entailed a good deal of extra work. In years when the crop falls at one period it is only necessary to do this once.

Experimental Tapping of Rubber Trees.

A special vote of \$1,750 was sanctioned this year for experimental tapping of Rubber trees, purchase of tools and utensils and erection of a drying house.

A substantial air-tight drying chamber has been erected in the Economic Gardens as well as a work shop for rubber work and a sufficient stock of enamelled plates, pans, collecting jugs, strainers, and aluminium collecting cups and the other usual tools for tapping were purchased and are available for future work.

In view of conducting the experiments on definite lines all trees of large size were numbered and registered, and all possible data, such as girth, description of tree, age whether previously tapped or not, were recorded for each tree.

Altogether 1,285 trees have been so registered and recorded, and of these, including some still under experiment, 880 have been tapped, and it is expected that the amount of dry biscuit rubber will give a pound a tree in all of which the average girth at three feet from the ground is $3\frac{1}{4}$ feet.

The experiments showed that the most favourable time for tapping were morning and evening, and from the same number of trees which produced a total amount of 578 lbs. the morning trees realised 314 lbs. while the evening trees fell to 263 lbs., showing a difference in favour of the morning tapping of 51 lbs. The diminished flow in the evening is no doubt to the loss of water pressure due to excessive transpiration during the hot part of the day, which had not been compensated for by the time of the evening tapping.

Experiments were also made in tapping by various methods, the action and results being carefully recorded, and also to discover the effects of tapping at different intervals of time. Measurements of trees were taken at different times of the day which showed the decrease in girth during the day and the increase towards evening.

Experiments were also carried out in mulching the trees with rotten leaves, and with cowdung.

All the rubber was prepared in the form of biscuit which it is expected will on analysis be found to give 97 per cent of pure rubber. It must be borne in mind that in preparing an almost pure rubber the average yield of a tree will be much less than was

the case with the first shipments from the East when the loss in washing amounted to 35 to 40 per cent, but it should also be expected that a higher market value would favour the purer article.

Drying experiments with the aid of Calcium chloride were carried out, but this could not be fully effected till the drying house was built and dry.

Tables of results of four experiments were published in the Agricultural Bulletin as well as the results of many other observations and experiments, and when all the experimental data of these four and two other experiments have been collected and tabulated and the rubber collected dried and weighed, a full report on this work will be prepared, the results of which will probably be found to be of the first importance.

Up to the present time 462 lbs. of biscuit rubber has been despatched to London for sale and the balance will be forwarded as soon as dry.

The greater part of these important experiments was carried out by the Assistant Superintendent Mr. R. DERRY, who devoted a great deal of his leisure time to this work. A Mandore and ten coolies were employed at the work for six months.

Receipts and Expenditure.

(1).—*Expenses of Carrying out Experiments on Rubber Trees, Vote for 1904, \$1,750.*

EXPENDITURE.

			\$	c.
Salaries of ten coolies and one Mandore	...	...	714	82
Cost of one drying chamber	...	...	505	22
Cost of one work-shop	...	...	200	00
Purchase of tools, jugs, strainers, cups, acid, calcium chloride, and enamelled plates	...	...	319	29
Balance	...	...	10	67
			<hr/>	
			1,750	00

(11).—*Upkeep of Economic Gardens, Vote for 1904, \$2,800.*

EXPENDITURE.

					\$	c.
Salaries	...	...	...	...	2,438	50
Tools and stores	...	...	...	...	329	84
Balance	...	...	...	...	31	66
					<hr/>	
					2,800	00

Coco-nut Trees Inspection.

During the year notices requiring the destruction of dead or dying Coco-nut trees and piles of rubbish infested by beetles were served on 180 persons, and four persons were prosecuted for not complying with the notice and fines to the amount of 41 dollars were inflicted. Dead trees to the number of 1,050 were destroyed and thirty-eight piles of rubbish removed.

				\$	c.
Vote	...	...	...	210	00
			EXPENDITURE		
Transport	...	...	...	188	74
Balance	...	...	...	21	26
				210	00

Government House and Domain.

The Overseer RAPPA resigned in October, EZEKIEL, Foreman-Gardener in the Economic Gardens, succeeded him. The charge of the Domain, however, reverted to the Aide-de Camp as was formerly the arrangement till 1893, when at the suggestion of the Director of Gardens they were put under his charge.

A Statement of Receipts and Expenditure of the Department during the year is attached.

*Receipts and Expenditure of the Botanic Gardens Department, Singapore,
during the year 1904.*

Item of Estimate.	Grant according to Printed Estimates 1904.	Extended during 1904.	Total for 1904.	Total Expenditure for 1904.	Balance on 31st December.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
I.—Personal Emoluments	14,010 00	...	14,010 00	12,854 32	1,155 68
<i>Other Charges.</i>					
2.—Expenses of carrying out the Provisions of the Coco-nut Tree Preservation Ordinance ...	210 00	...	210 00	188 74	21 26
3.—Expenses in connection with the Publication of the Agricultural Bulletin ...	300 00	...	300 00	300 00	...
4.—Expenses of carrying out Experiments on the Rubber Trees ...	1,750 00	...	1,750 00	1,739 33	10 67
5.—Grant to Botanic Gardens ...	11,000 00	a 5,393 83	16,393 83	15,815 68	578 15
6.—Travelling and Personal Allowance ...	500 00	190 75	690 75	690 75	...
7.—Up-Keep of Economic Garden ...	2,500 00	300 00	2,800 00	2,768 34	31 66
8.—Temporary Rice Allowance to Native Employés ...	396 00	...	396 00	385 41	10 59
9.—Furniture for New Office ...	...	600 00	600 00	599 00	1 00
Total ...	30,666 00	6,484 58	37,150 58	35,341 57	1,809 01

a.—This is the balance of last year and the Revenue collected during 1904.

H. N. RIDLEY,
Director of Gardens, S. S.

Botanic Gardens, Penang.

Staff.

No change in the Staff took place during the year and all worked well. There was a good deal of sickness about the middle of the year chiefly Dengue and Malarial fever. The ordinary Malarial fever of which we had a number of cases is said to be of a more virulent type in the Gardens than elsewhere in Penang.

Visitors.

A number of scientific men called in passing through to Buitenzorg where the facilities for studying the Botany of Malaya are unrivalled. Other visitors, especially passengers by the German Mails, continue to increase and it is now necessary to have a man stationed at the gates to regulate the gharries and rikishas and to prevent the coolies who linger about the gates annoying people by forcing their company on them as guides. There were no thefts except a very flagrant one at the Governor's Hill Gardens—where a lady tore down from a tree an Orchid in full flower. She was fined \$25.

The Weather.

2. The weather has been fairly normal, the rainfall was about the average. The total fall on the Hill for the year was 134.25 inches as against 123.35 inches on the plain. The wettest month was in August, 26.34 inches were registered on the Hill, and 26.33 inches on the plain respectively. March was the driest month on the Hill with 3.88 inches and February on the plain where 2.02 inches only were registered. The work generally was of a routine character such as propagating by seeds and cuttings the usual stock of plants kept for decoration and sale. Most of our permanent collections of pot plants have been repotted, and the upkeep of Flower beds

and borders has been maintained by manuring, top dressing and replanting where necessary. The exchanges of plants and seeds with other Establishments were as usual and plants and seeds to the value of \$854.35 were sold during the year. These were of the usual decorative character.

Upkeep of Buildings, Etc.

3. No new buildings were erected during the year, but repairs were effected in covering the octagonal Plant House with Nibong laths. This was absolutely necessary as the old wooden laths had become quite rotten. The large iron Plant House was fitted with a new set of Bertam Chicks and several of the smaller plant sheds and the Summer House were re-roofed with attaps. Probably more would have been done had we known definitely whether or not the Gardens will be required for a storage reservoir. What has been said in the three last reports on this head applies with more force as time goes on. Each year adds to the difficulty of moving the contents of the Gardens should it ever become necessary to do so, so that I trust ere long we shall know definitely what is going to be done. The question of quarters for the Overseer and coolies has become a serious one. Not only is the small attap building at the Chetty Temple Nursery far too small to accommodate one-third of the coolies, but it is in a ruinous state of decay and has had to be patched up and strengthened to prevent it falling down. This, as hardly needs pointing out, acts prejudicially on the health of the men when suffering from fever as they so often do.

Herbarium and Library.

4. In June I paid a short visit to Kedah and collected some Herbarium specimens at Gunong Grenong, a hill of about a thousand feet elevation, the interior of which is a vast cave. In December I paid a visit to the Langkawis and obtained some *Cypripediums* and other plants for our collections. I regret I was unable to visit the Island of Terutau as I had no steam launch at my disposal. I was therefore unable to get the very singular Balsam, *Impatiens Mirabilis*, which grows there, and which is such a desideratum for Kew, and for Sir JOSEPH HOOKER who is engaged on a monograph of the genus. The Director of Gardens, who is working up the Palms for the "Materials for a Flora of the Malay Peninsula," had the loan of specimens of *Dæmonorops* and *Calami*, whilst to Sir GEORGE KING who is elaborating the higher orders at Kew no less than 607 sheets of specimens were loaned comprising 12 natural orders from *Compositæ* to *Verbenacæ*.

Governor's Hill Bungalow Gardens.

5. These gardens have been kept in better order than hitherto owing to a slightly increased vote. Some Japanese plants have been introduced and are doing well especially *Hemerocallis* which flowers very freely. Some new roses have also been planted out and are doing well. Sergeant WELLS, the Signal Director, was in charge until November when he was promoted, and was replaced by Mr. SUTHERLAND.

Economic Plants.

6. The Para Rubber tree mentioned in previous Reports was again tapped on 14 occasions beginning on the 28th July and ending on the 6th September. As will be seen from the annexed table A the returns varied from 1 oz. the minimum, to 13½ ozs. the maximum. The idea was to tap on alternate days but owing to heavy rain this was not always practicable. The total amount obtained was 5 lbs. of wet Rubber which weighed 3 lbs. 14 ozs. when dry, thus raising the grand total from this tree to 26 lbs. 13 ozs. of fairly dry rubber for the nine consecutive years that it has been tapped. This gives close on an average of 3 lbs. per year, a magnificent result with rubber at its present price of say 5 shillings and sixpence per lb. The extraordinary high price obtained for Straits Rubber has induced the Forest Department in Lower Burmah to take up its cultivation and 100,000 seeds were supplied to them during the year through this department. As far as can be seen at present it seems impossible to overstock the market for years to come; so great is the demand for rubber for almost every conceivable purpose.

Gutta Percha.

7. The Gutta Percha trees in the Waterfall Valley fruited in August. Between 2,000 and 3,000 plants were raised which will be planted in the Forest Reserve at Batu Feringgi. Not a single enquiry for Ramie was received during the year.

Cotton.

8. The experiments during the year with Egyptian and Sea Island varieties of Cotton must be considered as having established the fact that in the cultivation of Cotton the Straits Settlements cannot compete with other Cotton-growing countries. This is especially so with the Egyptian variety.

The plant grows fairly well, but the impossibility of protecting it from rain when the pods are ripening will prevent it from ever becoming a staple crop. Reports

from Malakoff and Caledonia Estates where it has been tried corroborate our own experiments. As regards Sea Island Cotton the extensive trial at Golden Grove Estate is not yet complete so that a final judgment on that variety must be deferred to the next report.

Coco-nut Trees Preservation.

9. The number of notices issued during the year in Penang and Province Wellesley was 650. There were 5 prosecutions in Penang with 4 convictions. In Province Wellesley there were 19 prosecutions and 17 convictions. The fines realised being \$66.50, a very small sum which is I fear not sufficiently deterrent. The Inspector reports that the districts from Bagan Tuan Kechil as far as Ara Rendang, and from Bukit Tengah to Bukit Mertajam were towards the close of the year badly infested with beetles. The following table summarizes the work done during the year, the expenditure being shewn in Appendix C.

The Royal Horticultural Show.

10. In response to a notice of the Royal Horticultural Society of England which was published in the *Gazette*, that an exhibition of Colonial Fruits, either fresh or preserved in Syrups or tins, etc., would be held in London in December last, I got together with the permission of Government a small collection of 26 kinds of our local fruits and vegetables which the natives use as sweetmeats. The Secretary of the Royal Horticultural Society, the Rev. W. WILKS, M.A., informs me in a letter: "The fruits attracted considerable attention and the Council have awarded them a Silver Banksian Medal." This is distinctly encouraging and shews the possibility of a trade industry being opened up with the mother country when the small land-owner has been educated up to a knowledge of the advantages to be derived from fruit cultivation.

Agricultural Show.

11. The first of the new series of annual Agricultural Shows was held in Kuala Lumpur in August and was a complete success. As full reports have appeared in the Bulletin and the Press it is unnecessary to allude to it further than to say that Penang came in for a share of the prizes. The nutmegs and cloves were particularly fine and were easily first.

Expenditure.

12. The total amount of Government Grants under the heading of Botanic Gardens amounted to \$7,510, of which \$7,374.43 was expended, particulars of which are given in Appendix C.

A Statement of Receipts and Expenditure of the Department during the year is attached.

Receipts and Expenditure of the Botanic Gardens Department, Penang, during the year 1904.

Item of Estimate.	Grant according to Printed Estimates 1904.	Extended during the year 1904.	Total Grant for 1904.	Total Expenditure for 1904.	Balance on 31st Dec., 1904.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	6,264 00	...	6,264 00	5,463 00	801 00
2.—Expenses of carrying out the Provisions of the Coco-nut Tree Preservation Ordinance ...	270 00	...	270 00	262 34	7 66
3.—Maintenance of Waterfall Gardens...	4,960 00	...	4,960 00	4,907 33	52 67
4.—Purchase of Books and Periodicals ...	100 00	...	100 00	83 79	16 21
5.—Travelling and Personal Allowance ...	440 00	...	440 00	439 54	0 46
6.—Up-keep of Grounds of Governor's Hill Bungalow ...	1,500 00	240 00	1,740 00	1,681 43	58 57
7.—Temporary Rice Allowance to Native Employés ...	216 00	...	216 00	216 00	
Total ...	13,750 00	240 00	13,990 00	13,053 43	936 57

W. FOX,
Superintendent, Forests and Gardens.

APPENDIX A.

Date of Tapping, 1904.	Weight of wet Rubber obtained at each operation, in ounces.														Total weight of wet Rubber.		Weight when dry.	Remarks.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lb	oz.			
From 28th July to 6th September	0	1	2	2½	3¾	4¾	7¾	8	4½	10½	8	13	13½	11	5	0	3	14	* The 9th tapping only 4½ ounces of wet rubber was obtained owing to a sudden shower of rain washing the rubber from the tin cups.

APPENDIX B.

Name of District.	No. of Coco-nut trees destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District.	225	547	120	9	78	} 19	\$ 6.	
Province Wellesley, Central District.	41	323	188	6	104		54 00	
Province Wellesley, Southern District.	55	129	119	...	64			
Penang Island.	219	1,498	824	60	404	5	12 50	
Total.	540	2,497	1,251	75	650	24	66 50	

APPENDIX C.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1904.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
<i>Government Grants.</i>		{ Wages	3,409 26
Maintenance of Water- fall Gardens ...	4,960 00	{ Stores, Tools and Materials ...	143 70
		{ Pots and Tubs	268 04
		{ Manure and Cartage	81 95
		{ Freights	39 23
		{ Typewriter ribbon	1 60
		{ Chicks for Plant Sheds	96 98
		{ Miscellaneous & Petty Expenses	866 57
			4,507 33
		Balance	52 67
<i>Government Grants.</i>		Total	4,960 00
Upkeep of Grounds of Governor's Hill Bunga- low	1,500 00	{ Wages	1,490 76
Extension	240 00	{ Tools and Attaps	33 13
		{ Manure	79 93
		{ Flower Pots	77 61
	1,740 00		1,681 43
		Balance	58 57
<i>Government Grants.</i>		Total	1,740 00
Travelling and Personal Allowance	440 00	{ Pony Allowance	240 00
		{ Passages, Personal and Field Al- lowance	199 54
			439 54
<i>Government Grants.</i>		Balance	0 46
Expenses of carrying out the provisions of Coco- nut trees Preservation Ordinance	270 00	Total	440 00
		{ Allowance to Inspector of Coco- nut trees	240 00
		{ Destruction of dead Coco-nut trees... ..	22 34
			262 34
<i>Government Grants.</i>		Balance	7 66
		Total	270 00
Purchase of Books and Periodicals	100 00	{ Books and Periodicals	83 79
		{ Balance	16 21
Total Government Grant	7,510 00	Total	100 00

	\$ c.
Revenue from Plant Sales ...	851 45
„ Swimming Bath ...	2 90
Total collected ...	854 35

W. FOX

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS

SINGAPORE AND PENANG,

FOR THE YEAR

1905

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.



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1906.

Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1905.

Staff.

No changes took place among the Staff during the year except that caused by the dismissal of JAPHET S. ISAAC, Foreman Gardener, of the Economic Gardens, who was succeeded by SATHIANATHAN.

The cooly supply was still short and the men obtained were an inferior lot. Very few stay for any length of time as Javanese labour is scarce anywhere now, and the men can get employed at higher wages outside. A considerable number run away immediately after receiving their pay without giving any notice, and this is especially the case when it happens to be necessary to pay the salaries early in the month. The Ordinance to prevent this is quite inefficacious, as it is much too expensive in time and money to hunt for the fugitives, even if it were possible to find them again.

There was no sickness of any importance among the coolies during the year.

Visitors.

As was to be expected, the number of visitors to the Gardens fell off very largely owing to the abolition of the menagerie. It is no exaggeration to say that hundreds of people enquired for the animals and left the Gardens as soon as they found they were there no more. The natives, who used to come in crowds on Native Holidays, have ceased to come, and the European travellers who had been to Singapore before, or who had heard from others of the menagerie, were surprised to find the animals gone, and many left the Gardens when they discovered the fact.

The Regimental band played in the Gardens four times only and the performances were well attended.

A large number of persons interested in rubber cultivation and other vegetable products visited the Gardens. Among these were M. CIBOT (Paris), Mr. JOHN ALLEN (Warrington) interested in oilseeds, Mr. VERNET (Agricultural Department of Annam), Dr. WATERHOUSE (Honolulu), Mr. G. KAYABASHI (Osaka), Mr. HAGEDORN (Samoa), Dr. PREUSS (New Guinea), M. LAURENT (Deli), M. BRUINSMA (Inspector-General of Forests, Buitenzorg), Mr. SCHEITIN (Illinois, U.S.A.), Mr. STRICKLAND (Madras), Dr. SCHWARA (Tokio), Mr. GOODRICH (Australia), CARL LINOW (Bangkok), and many others.

Professor ENGLER of Berlin, spent a week in Singapore, studying the Aroids, wild and cultivated, and other local plants.

Prince and Princess ARISUGAWA visited the Gardens on the occasion of their visits, to Singapore.

Thefts, etc.

There were no very important cases of theft during the year, but there were three prosecutions: one Chinaman, for gathering Champaca flowers, fined \$10; another, for digging up roots in the Garden jungle, fined \$2, and one for cutting large quantities of Heliconia leaves, alleging, when first detected, that he had paid one of the Officials for them. He was fined \$30.

There was a case of suicide in the Gardens, a Dutchman having shot himself in the little summer-house near the lake. This is the first case of the kind for about 18 years.

Aviaries.

The remaining birds and animals were sold off during the year, mostly at a very low figure. The Mias, the old Binturong, the best of the hybrid Apes, an Arctogale, and the white Porcupine were sent to the Zoological Society's Garden in London,

Mr. GOODFELLOW kindly conveying them there. All arrived safely except the white Porcupine, which succumbed in the Red Sea.

The cages were for the greater part pulled down, and some of the ironwork sold. A great deal of the iron and woodwork was found to be completely rotten, and it would have entailed a considerable expense to have renewed it.

The remaining black swan was found dead by the lake one morning, and there is reason to believe it was killed by a dog belonging to a visitor.

Buildings and Upkeep.

The Aroid-house was practically re-built, the woodwork replaced by brick pillars and T iron, and roofed with chicks laid over wire netting. The glass house has been completed and has proved very satisfactory for cultivating plants which require a dryer air than in the open sheds. The large mud drain round the band-stand, which was unnecessarily broad and very unsightly, was narrowed and bricked all round, adding an extra width of two feet to the road all round; the total length of this drain is 200 yards. The Khôpalobla-ter avenue road had become very rough and worn, and the mud side-drain was bricked for 77 yards. The path was raised a foot for 247 yards and regravelled, and the edges returfed. The old deep open drain running from the band-stand across the grassplot was filled in and a drain of 6-inch earthen pipes run for the length of 110 yards and a terminal portion of brick drain of 21 yards long with three cemented catchpits at various points. The Sabal avenue from the tuckery to the canna ground was re-formed and regravelled for 90 yards, and an open drain of 60 yards was bricked on one side. The path leading from the terminus of this avenue to the band-stand was re-dressed, regravelled, and the drains on both sides re-bricked for a length of 90 yards, and one cemented catchpit was made. The Red-stemmed palm avenue had an unsightly and too deep mud drain running for 98 yards. This was partly filled in and a brick drain laid, the edges being returfed. Two catchpits were also built at the upper end, and connected by twelve 6-inch earthen pipes so as to drain off from the band-stand a considerable quantity of water during rain. The road by the old well was improved by bricking the open drain for a distance of 37 yards and re-made the drain beneath the path with 6-inch pipes and two cemented catchpits.

The mud drain round the aviary hill along the main drive from the big white Champaca tree to the new Herbarium was filled in and bricked for a length of 170 yards. A twenty-four foot culvert was made under the main road between the plant house and the office. Some of the trees surrounding the old well being found to be in a dangerous state, were removed and the wall of the well, much broken by the roots, was repaired.

The very dry weather from May to November occasioned as in last year a great expenditure in cart hire for conveying water from the lake to the plant houses, including the cost of coolies loading and unloading the water. It is estimated that this year cost no less than \$1,000. As these spells of dry weather seem to be becoming more constant every year, it is hoped that a proper water supply may be laid on from the lake to supply the Gardens, and do away with this heavy expenditure.

A fine series of water lilies was established in pots which were sunk in the lake, at first in shallow water and as they grew larger transferred to baskets and moved to deeper water, all round the edge of the lake. They flowered well and formed quite an attraction especially in the early morning when they were at their best. *Nymphaea stellata*, *Devoniensis* and *O. Marana* were particularly fine. More plants of the *Victoria regia* were also planted and soon flowered.

A number of Gladioli, obtained from Messrs. SANDERS, were planted out in a bed and flowered very well. It is seldom that these plants are seen in Singapore.

In the large plant house, the ferns were re-arranged, and a number of local species added. The collection of Adiantums is now a fairly good one and contains some very fine species. The other ferns were arranged according to groups.

Professor ENGLER of Berlin, the greatest authority on Aroids, during his stay in Singapore, identified many of these plants of which the names had been lost.

New or Noteworthy Plants.

The following were among the most interesting of the plants which flowered here for the first time:—

Malayan — *Cryptocoryne pontederiaefolia*. — (Johore).

Monophyllax Horsfieldii. — (Perak).

- Bauhinia integrifolia*.—(Malay Peninsula).
Bauhinia bidentata.—(Malay Peninsula).
Chirita rupestris.—(Lankawi).
Pholidota grandis, n. sp.—(Selangor).
Ixora Scortechinii.—(Tringganu).
Homalomena Lindenii.—*Alocasia Lindenii* Hort.—(New Guinea).
Plocoglottis borncensis, n. sp.—(Borneo).
Saccolabium brachystachys, n. sp.—(Borneo).
Canavalia obtusifolia, var *insularis*.—(Christmas Island).
Arisæma umbrina.—(Borneo).
Vanda trichoglottis.—(Borneo).
Fagera speciosa.—(Borneo).
Artanema sesamoides.—(Johor).
Eranthemum album.—(Selangor).
 Indian :—*Trichodesma zeylanicum*.
 Vanda Bensoni.
 Mussœnda macrophylla.
 Lagerstrœmia indica.
 Shan States :—*Globba new species*.
 Africa :—*Clinogyne ugandensis*.
 Australia :—*Melochia Holtzei*.
 Cynoglossum australe.
 South America :—*Cecropia palmata*.
 Eichornia martiana.
 Tibouchina semi decandra.
 Stemmadenia bella.
 Stigmaphyllon ellipticum.
 Wulfia stenoglossa.
 Erythrochiton braziliensis.
 Crmo in falcata.
 Chamœdorea martiana.
 Attalea Cohune.
 Montrichardia arborescens.
 Gliricidia maculata.
 Passiflora amabilis.
 Pitcairnia maidifolia.
 Solanum atropurpureum.
 Solanum pyracanthum.

New Introductions.

Among the most interesting of the foliage plants introduced during the year were:—

FERNS.—*Nephrolepis Piersoni*, *Adiantum glaucophyllum*, *A. excisum*, *A. rhodophyllum*, *A. stenochlamys*, *A. decorum*, *A. formosum*, *A. intermedium*, *A. Victoriae*, *A. Hendersoni*, *A. Williamsi*, *A. Lawsoni*, *A. Flemingi*, *Meniscium Hosei* (Borneo), *Alsophila Burbridgei* (Borneo), *Anisogonium decussatum* (Borneo), *Lindsaya cultrata* var (Borneo), *Asplenium porphyrorachis* (Borneo), *Diplazium polypodioides*, *Pleopeltis affine*, *Aspidium Plantaginum* (all from Borneo).

CYCADEÆ.—*Stangeria schizodon*, *Schizocycas Miholitzii*, (one of the two plants of this rare and curious Cycad made good growth during the year).

AROIDS.—*Philodendron cannaefolium* (S. America) *Piptospatha insignis*, *Raphidophora grandis* n. sp. *Pothos* sp. and a number of *Chismatoglottis* of various kinds were also introduced from Borneo.

LILIACEÆ.—*Gloriosa Rothschildiana* from Uganda, *Dracæna phrynoides* from Africa and another species with deep green leaves ornamented with round green spots was obtained from Borneo.

PALMS.—*Martinezia corallina* (Guiana) *Chamædorea* sp. and *Malortiea gracilis* from Mexico, *Calamus rudentum* and *C. rivalis* from Ceylon, *C. n.sp.* from Borneo, *Zalacca borneensis* from Borneo, *Indes caularum* (Porto Rico) *Livistona Woodfordi*, and *Ptychosperm n.sp.* from the Solomon Islands.

CONIFERÆ.—A number were introduced from Japan including *Thujopsis dolabrata*, *Sciadopitys verticillata*, *Juniperus rigida*, *Chamaecyparis breviramæa*, *C. obtusa* and several varieties of *C. pisifera*; and among plants of other orders chiefly noticeable were a new and handsome *Begonia* from Borneo, *Pedilanthus titnhymaloides*, var. *variegata* (Rangoon) *Pandanus Luzonensis* (Philippines) *Hydnocarpus Heterophyllus* (Saigon) *Musa Gilletti* (Congo) *Alocasia Singaporensis* (Rangoon).

Plants Received.

During the year 4,158 plants and 368 packets of seeds were received, besides the usual poor cleared stock of flower seeds. The donors were Mr. MICHOLITZ; Mr. SCHIRMER; Messrs. BOEHMER (Japan); Mr. J. O'BRIEN; Mr. E. M. HOLMES; Mr. C. WOODFORD (Solomon Islands plants); Mr. S. MOORHOUSE; Mr. A. D. MACHADO; Mr. VADE; Mr. LUCAS (Jamaica); Mr. H. W. WALKER; Mr. PEREIRA; Messrs. DAMMAN; Dr. GIMLETTE; Mr. C. GOLDHAM; Colonel PENNEFATHER; Mrs. FREER; Mr. ST. V. B. DOWN; Mr. J. C. HARVEY (Mexico); Captain AHERN (Manila); Messrs. HERB (Italy); Dr. BUSSE; Messrs. SANDER; Mr. BURCKHARD; Colonel L. POWER (Madeira); Mr. S. ARDEN; Right Reverend BISHOP HOSE; Mr. CHOA KIM KEAT; Mr. W. W. WALLACE (Amoy); Mr. HEWITT; and the Directors of the Botanic Gardens of Kew, Sydney, Saigon, Jamaica, Ceylon, British Guiana, Natal, Entebbe, Uganda, Congo, Trivandrum, Calcutta, Trinidad, Arnold Arboretum, Rangoon, Porto Rico, Port Darwin and the Agricultural Department of Manila.

The Director during a month's stay on leave in Sarawak obtained a large number of rare and new plants of which 7 cases were brought or sent to Singapore. They consisted chiefly of ferns, palms, Orchids and Aroids.

Plants and Seeds Distributed.

Exclusive of Para rubber seeds and plants, 1,753 plants and 371 lots of seeds were distributed to various persons and establishments in exchange. The recipients were Mr. GEBEL, (Batavia) Mr. ST. V. DOWN, Messrs. DAMMAN; Mr. HARVEY, Dr. GIMLETTE, Mr. MACHADO, Superintendent of Works and Surveys (plants for Cape Rachado) Dr. MCCLOSKEY, Herr GIRSCHNER (Carolines) Col. Power, J. D. PEREIRA, Messrs. SANDER, Professor GAMMIE, (Poona) Resident Councillor, Malacca, Professor JACQUET (Hanoi), Col. PENNEFATHER, Superintendent Government Plantations, Perak, Conservator of Forests, Kuala Lumpur, Mr. GOLDHAM; Resident, Perak, R. H. C. CRAWFURD (Bahamas) J. C. O'BRIEN, G. T. HARE, W. S. LYON (Bureau of Agriculture Manila) S. ARDEN (Batu Tiga Gardens) CHOA KIM KIAT, C. ROBELEN; St. Joseph's Institute, St. Mary's College, VALENTINE DUKE (Ceylon) Mr. NONGCHIE, (Istana, Johor) Mr. VON USLAR; Mr. BURCHARD, W. R. SMITH (Buluwayo) L. E. KIRWAN (Madras). The Gardens and Botanic Institutions of Kew, Sydney, Lagos, Ceylon, Melbourne, Trivandrum, Buitenzorg, Natal, Uganda, British Guiana, Old Calahar, Saharunpur, Rangoon, Jamaica, Gold Coast, Trinidad.

Herbarium.

The Herbarium Cabinets were transferred to the new building, but little could be done with the museum portion of the building as there was no money for furniture and the whole building was very leaky and damp for a great part of the year.

A considerable collection of herbarium specimens was obtained by the Director during an expedition on leave to Sarawak, 13 specimens of Hongkong plants were presented by Mr. DUNN, 8 specimens from Perak and Malacca by Mrs. BLAND. Five specimens were received from Calcutta.

Three hundred and twenty-five specimens of Japan plants were received in exchange from and a few specimens from the Right Reverend Bishop HOSE, Mr. BARNARD and others.

Specimens were sent for naming or exchange to Calcutta, Sydney, the British Museum and Kew, and Dr. ENGLER took three packets with him for Berlin; 316 plants were sent to Dr. TRELEASE and a collection of varieties of Paddy was sent to the Imperial Institute.

The Collection of *Piperaceæ* was sent to M. C. De CANDOLLE to be examined for the working out of the order for the Flora of the Peninsula which he has undertaken.

Publications.

The Monograph of the Malay Peninsula Gesneraceæ, was published in the *Journal of the Straits Branch of the Asiatic Society*, and also a paper on the Aroids of Borneo.

The Agricultural Bulletin was published as regularly as could be done, and was in as much demand as ever. A list of the Aroids cultivated in the Gardens was published and copies distributed to Gardens and other Institutions for exchange purposes.

The Artist continued making drawings of rare and interesting plants, and also made a number of diagrams for the Botanical Lectures at the Medical School. A course of these lectures was given by the Director to the students lasting for about 3 months, two lectures a week being given. This being the first course delivered and there being no diagrams, specimens, books, etc., in readiness when the school commenced work, occupied a very large proportion of the Director's time during the session.

Library.

The following books and papers were added to the Library during the year:—

PRESENTED.

- Van Hall, G. J. J.—Inspectie Van den Landbouw in West Indie.
 Edwards, H. T.—Abaca.
 Barraclough, Th.—Ramie, Rhea and China grass.
 Woodrow, G. M.—The Mango.
 Wildeman, E. de—Notices sur les plantes utiles et interessantes de la Flore du Congo, (continuation).
 Raciborski, Dr. M.—Parasitische Algen und Pilze Java's.
 Watts, Fr.—Manurial experiments with Sugarcane in the Leeward Islands.
 Vines, S.—Proteases of Plants.
 Beccari, O.—Palme nuove papuane.
 Beccari, O.—Li Palmi del genere *Trachycarpus*.
 Busse, W. Uber.—Heil und Nutzpflanzen Deutsches Ost Africa.
 Busse,—Uber das auftreten epiphytischer kryptogamen von Kamerun.
 Busse,—Weitere Beitrage zur gattung *Strychnos*.
 Eckart, C. F.—Field experiments with Sugar Cane, Honolulu.
 Eckart, C. F.—Comparative analyses of varieties of Cane.
 Eckart, C. F.—Irrigation Experiments.
 Pit.—Eenige Proeven met Phosphor zuur Bemesting.
 Kramers, J. G.—Andere Mededeelingen over Koffie.
 Hissink, D. J.—Een studie over Deli-Tabak.
 De Candolle, A.—*Tiliaceæ et sterculiaceæ novæ*.
 Lundia Damazei.
 Observations Heratologiques.
 Tromp de Haas, W.—Uit Kommsten van de in 1904 verrichte aflappings proeve van *Hevea Braziliensis*.
 Bottomley, John—Cotton growing in the Northern Territory, S. Australia.
 Wellborn, W. C.—Soil fertility of the Philippines.
 Barber, A.—Haustoria of sandal roots.
 Barber, A.—Report on the work of Samalkot Experimental Sugar farm.
 Freer, P. E. and Polk, M.—Description of the new buildings and Catalogue of Library of Government Laboratories, Manila.
 Duthie, J. F.—Flora of Upper Gangetic Plain.
 Duthie, J. F.—Cultivation of oranges in Dominica.
 Martelli, U.—Webbia.
 Herzog, M.—The Plague.

Wherry, W. B.—Glanders.

Merrill, E. D.—Revision of species of Blanco's Flora des Philippines.

Strong, Dr. R. P.—Clinical and Pathological signification of *Balantidium Coli*.

Lewis, G. N.—Anticatalytic decomposition of Silver oxide.

Christ, T.—Filices Faurianæ.

Filices Borneenses.

Filices Uleanæ Amazonicæ.

Smith, J. J.—Die Orchideen von Java.

Smith, J. J.—Die Orchideen von Ambon.

Purchased.

Mueller Ferd ver.—Fragmenta Phytographiæ Australiæ (parts.)

The following journals were also presented by the Editors:—

Chemist and Druggist, India Rubber World, Tropical Agriculturist, Weekly Times of Ceylon, Queensland Agricultural Journal, Trinidad Bulletin, Jamaica Bulletin, West Indian Bulletin, Agricultural News, Journal of the Board of Agriculture, Acta Horti Petropolitani, Bulletin des Etudes Coloniales, Natal Agricultural Journal, Tropenpflanzer, Cape of Good Hope, Agricultural Journal, Journal of New York Botanic Garden, Contributions from the Botanical Laboratory of the University of Pennsylvania, Experiment Station records, Indian Forester, Kew Bulletin, Bulletin of the Agricultural Society of Western India, Journal d'Agriculture Tropicale, Journal of the Department of Agriculture, Western Australia, Bulletin van het Koloniaal Museum, Harlem, Circulars of the Botanic Gardens, Ceylon, Annual Reports of Agricultural Department of British Guiana, New South Wales, Grenada, Cape of Good Hope, Parks and Gardens of Detroit, Uganda, Zurich, Bureau of Forestry Manila, Trivandrum, Santa Lucia, Bureau of Laboratories Manila, Radipur, Ceylon, Mycological Notes, Notizblatt, Report of Botanical Survey of India, Circulars of Department of Agriculture, Cuba, Bulletin of the Imperial Institute, British Honduras Society of Agriculture, University of Colorado Studies, Mercks Annual Report, Journal of the Department of Agriculture, West Australia, Natal Agricultural Journal.

The following journals were purchased:—Gardener's Chronicle, Indian Gardening and Planning, India Rubber Journal, Botanical Magazine.

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS, SINGAPORE, FOR THE YEAR 1905.

RECEIPTS.		EXPENDITURE.	
	\$ c.		\$ c.
By Balance in bank on 1st January, 1905 ...	654 52	Salaries ...	6,039 23
Government Grant for the year 1905 ...	8,000 00	Pots and Tubs ...	816 76
By Sale of Plants and Seeds ...	5,581 72	Cartage ...	729 07
By Sale of Rubber ...	2,440 00	Gravel, Laterite, Sand and Manure ...	426 93
Interest ...	30 83	Timber and Planks ...	292 66
		Lime and Bricks ...	336 66
		Tools and Stores ...	659 59
		Petty Expenditure ...	552 42
		Wardian Cases ...	387 48
		Baskets, etc. ...	44 12
		Telephone ...	90 00
		Birds and Animals Food ...	661 42
		Plants and Seeds ...	488 03
		Petty Repairs ...	391 75
		Uniforms, etc. ...	128 00
		Freight on Plants and Seeds ...	1,000 01
		Bertem Chicks ...	74 81
		Acid, Jeys' Fluid, etc. ...	110 13
		Books and Papers ...	63 00
		Bonus to Assistant Superintendent ...	500 00
		Gratuity to Aviary-Keeper ...	75 00
		Refunds to Government ...	1,200 00
		Miscellaneous ...	378 97
		Balance in Bank on 31st December, 1905 ...	1,261 03
Total ...	\$16,707 07	Total ...	\$ 16,707 07

Economic Gardens.

During the year, a piece of ground, one and a half acres, lying near the citronella grass patch, was cleared and dug, and planted with rows of *Ficus elastica*, alternated with Coffees of different kinds, and Bananas. The soil here is very good though somewhat damp, and is not subject to flooding as is a good part of the ground in this part of the Garden. The *Ficus* made very good and rapid growth, although some plants were attacked by *Glyphodes* Caterpillars.

The grass beneath the rubber trees had to be cut twice during the year in order to secure the seeds. This work took a great deal of time, as the area is large.

Many rubber seedlings were grown to supply the very large demand for them. A plague of small brown slugs attacked the young plants in the beds, and also damaged the young trees planted out.

The Ramie beds were dug and fresh ones made. The *Sanscveria* cultivation was also increased as much as possible. A number of *Bromelia Fibre* plants were transferred to this part of the Garden where they made fair growth.

Besides Rubber plants for which there was a much larger demand than it was possible to supply, the chief demands were for fruit-trees, Betel-nuts, Cananga, Nutmegs, Tea, Coca, Timber trees, and Shade trees, Ramie, *Musa textilis*, *Sanscverias* and *Fourcroya*.

Para Rubber.

The demand for plants and seeds of Para rubber still kept larger than any possible supply, of seeds 390,724 were disposed of as well as 8,920 plants. Most of the seed went to the Colony and Native States, lots were also sent to Jamaica, Lagos and Nigeria. These long distance voyages were usually very successful, thus of 7,500 seeds sent to Jamaica, after nearly 3 months travelling, Mr. FAWCETT reports "all germinating very well we shall scarcely lose 500."

One hundred were sent to Old Calabar experimentally, a two months' voyage and ninety came up. Of 135 sent to Kew, 123 germinated. These seeds were sent in charcoal carefully damped, and packed in biscuit tins. These successful experiments show that Para Rubber seed though short-lived can be sent to almost all parts of the world with but a comparatively small loss.

Applications were received for seed from all parts of the world, many of which were from places where there could be no chance of successful cultivation of the plant. As the stock was very early over-booked, a large number of requests had to be refused.

					\$	c.
Vote	...	...	...	...	2,850	00

EXPENDITURE.

					\$	c.
Salaries of 26 Coolies	...	...	...	...	2,385	15
Hand Cart	...	...	...	...	35	00
Tools and Stores	...	...	...	...	211	66
Baskets, etc.	...	...	...	...	75	80
Pots and Tubs	...	...	...	...	121	52
Manure	...	...	...	...	20	47
Balance	...	...	...	...	00	40
					<hr/>	
					2,850	
					<hr/>	
					00	

Inspection of Coconut Trees.

During the year notices were served on 209 persons, and 885 dead and dying trees and fifty piles of rubbish harbouring beetles or likely to do so were removed and destroyed. No prosecutions were necessary. The red beetle is not by any means exterminated in Singapore nor is it really possible to utterly exterminate it, but it is kept in check to such an extent that it is really comparatively rare, and the amount of harm it does is very small now.

					\$	c.
Vote	...	...	...	...	210	00

EXPENDITURE.				\$	c.
Transport	...	...	...	197	78
Uniform	...	...	...	8	00
Balance	...	...	...	4	22
				<u>210</u>	<u>00</u>

Experimental Rubber Tapping.

The vote of \$1,200 for these experiments was renewed this year, and the experiments were continued. The calcium chloride house was used during the year but was not so effective as was hoped, though it certainly aided in quicker drying. Sixteen men were employed during the latter part of the year, in tapping and preparing the rubber. A large iron pan was purchased for drying the calcium chloride, and a brick oven built for heating it. The rubber sent home last year fetched 6s. 9½d. and 6s. 3½d. a lb., being the highest market rates at the time. The sum of \$2,440 was obtained by the sale. The money advanced by the Government was refunded and a bonus of \$500 was given to the Assistant Superintendent. The remainder was paid into an account for carrying on further experiments. A report on the previous year's work was presented to the Legislative Council, and ordered to be published which was done in November. Nearly a thousand pounds of rubber was made also during the year, which will also be sold in 1906. The result of the experiments made during the year will be published as soon as they are completed.

during the year will be published as soon as they are completed.				\$	c.
Vote	...	...	...	1,200	00
EXPENDITURE.				\$	c.
Wages	...	...	...	786	88
Calcium Chloride, Tools, etc.	...	...	...	405	91
Balance	...	...	...	7	21
				<hr/>	
				1,200	00

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT, SINGAPORE, FOR THE YEAR 1905.

ITEM OF ESTIMATE.	Vote for 1905.	Expended in 1905.	Balance on 31st December, 1905.
	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	9,036 00	8,988 00	48 00
<i>Other Charges.</i>	...	...	...
2.—Expenses of carrying out the Provisions of the Coco-nut Trees Preservation Ordinance	210 00	205 78	4 22
3.—Expenses in connection with the Publi- cation of the Agricultural Bulletin	300 00	300 00	...
4.—Expenses of carrying out Experiments on Rubber Trees	1,200 00	1,192 79	7 21
5.—Grant to Botanic Gardens	* 16,707 07	15,446 04	1,261 03
6.—Travelling and Personal Allowance	500 00	361 60	138 40
7.—Up-keep of Economic Garden	2,850 00	2,849 60	40
Total	30,803 07	29,343 81	1,459 26

* \$8,707.07 of this amount is the Revenue collected during the year and the balance remained in 1904.

H. N. RIDLEY,

Director of Gardens, S. S.

Botanic Gardens, Penang.

Staff.

1. No change in the Staff took place during the year and all worked well. There is difficulty in keeping trained Gardeners. No sooner do they get to know the rudiments of their work than they leave, and the same task of teaching has to be recommenced. There was the usual amount of sickness chiefly Malaria, the ordinary cases are treated at the office where a stock of simple medicines is kept and only the complicated cases being sent to Hospital.

Visitors.

2. The number of Visitors especially on Mail days seem to increase indeed the number of passengers brought by the German Mails is amazing. There were fewer scientific visitors but among the latter was the Inspector-General of Forests in Netherlands India. His mission was to study the methods of cultivating and preparing Para Rubber and also to visit the Teak Forests of Burma. I am glad to be able to report that no thefts occurred during the year.

The Weather.

3. The year under review must be distinctly classed as a dry one. The total rainfall on the Hill amounted to just over 100 inches, 100.09 as against 134.25 last year. On the plain 78.31 only was registered as against 123.25 a difference of nearly 45 inches. Usually the effect of a dry year is to cause many Forest trees to flower that only do so at long intervals, so far however this effect has not been noticeable.

4. For reasons mentioned elsewhere the work of the first three parts of the year was of a routine character. A special effort was made however to have a bright display of plants at the Show. A fine batch of the new pink flowering tobacco, *Nicotiana Sanderiana*, a group of well flowered pinks and other annuals, together with a fair show of Orchids were sent, and helped to brighten up the plant section considerably. As regards the competitive exhibits in this section, Penang hardly did itself justice. It is with pleasure I have to report the great interest shewn in the cultivation of roses by a number of our wealthy Chinese, and also to some extent in Orchids. The demand on our stock of the former plants was so great and which could not be met that I suggested importing some from home. Upwards of 200 of the best sorts of roses have been specially imported for them, and also a number of Cattleyas, the beautiful South American Orchids. It is hoped this awakened taste and love of gardening will increase.

5. A new walk lined with rockeries has been commenced, starting from the wooden rustic bridge, and running parallel with the stream to the stone bridge at the top of the Gardens, this when finished will form a most pleasant walk, it is the intention to have a good collection of Penang ferns on these rockeries.

6. The exchanges of plants and seeds with other Establishments was not quite up to last year and the amount realized in sales of plants amounted to \$566.80 as against \$854.35 for 1904. The amount collected represents our normal sales, the higher amount in 1904, being due to a large collection of plants sold to the Kedah authorities for the wedding festivities which took place that year.

Upkeep of Buildings, Etc.

7. A vote of \$500 was put in the Estimate for coolie lines, as however the Overseer's Quarters were badly in need of repair, \$200 of this sum was used in repairs to them, leaving \$300 for new coolie lines which have been erected, but which are too small to accommodate all our coolies. I hope to see the lines extended if possible during the present year.

8. The plants houses have had repairs effected where necessary and all the tables in the Orchid houses have been cemented as a means of keeping away white ants which have proved so troublesome. The roofs of the Iron house and No. 1 the Begonia house have had new sets of chicks.

Herbarium and Library.

9. The only collecting tour I was able to take was in October when the new steamer "Sea Gull" was placed at my disposal for a few days and I took the opportunity of visiting Pulau Terutau principally to get the *Impatiens Mirabilis* which I was unable to get the previous year. I got a stock, some of which have since been sent to Kew. I regret to report that although the greatest possible care was taken in packing, the largest specimen sent, arrived in a damaged condition. It is a notoriously

bad traveller, as it is as brittle as a carrot. A number of other plants were obtained. The specimens loaned to Kew last year are still there, and are being worked up by Mr. GAMBLE an eminent Indian Botanist for the "Materials for a Flora of the Malayan Peninsula."

10. The usual service Periodicals and a number of new books on Economic Botany and Agriculture have been added to the Library together with presentation copies of the Reports and Bulletins of various kindred institutions.

Governor's Hill Bungalow Gardens.

11. These have been kept up in good order during the year under the charge of Mr. SUTHERLAND. One of the drawbacks to good cultivation is the want of manure (which exclusive of cost and cartage to the foot of the Hill) cost \$1.00 per picul to carry up, a price that is prohibitive except in small quantities for special things. The Tindal who has been employed there for some years fell ill towards the close of the year and I am afraid will not be fit for work again up there.

Economic Plants.

12. To such an extent has Para Rubber usurped the attention of Agriculturists that such staple products as Coffee, Tea, Ramie, Cotton, Pepper and other well known products have been entirely neglected, and the demand is still for Rubber. New Estates are being formed and old ones floated into companies so that there is still even locally a strong demand for seeds. It is however the neighbouring countries of Burma and Sumatra that the large orders for seeds come. Over a quarter of a million seeds were sent to Burma last year from the Straits alone. Letters of enquiry as to the supply of seeds and to the suitability of such places for growing Rubber as the Nicobars and Mysore on the one hand, to Samoa on the other have been received. The Veteran tree in the Gardens here was again tapped during the year and produced 4 lbs. 12 $\frac{1}{4}$ oz. of fairly dry Rubber. This makes the 10th consecutive year of tapping and raises the total production of this tree to 31 lbs. 9 ozs.

Cotton.

13. As mentioned in last years' report it was that too early to form an opinion on the large trial of Sea Island Cotton which was being conducted at Golden Grove Estate. I regret to say that equally with Egyptian Cotton, it was a failure. Mr. A. CRAWFORD the General Manager writes. "We picked some very nice Cotton at first, but then we got rain which yellowed it and that little red bug showed up in thousands. I showed some of it to a Cotton broker who told me that the staple was very short and not of much value. We have now given it up entirely".

14. At the request of the General Manager of Malakoff Estate, the Department imported from India some 200 plants of Ipecacuanha, they were planted out in March. I saw them a few months afterwards most of them were alive but having lost their original leaves they looked anything but promising. It is a very slow grower and comes to maturity slower than any crop I am aware of.

Coco-nut Trees Preservation.

15. The number of notices issued during the year in Penang and Province Wellesley was 1023 as against 650 in 1904. There were eleven cases of prosecution in Penang and 12 in the Province. The fines realized being \$45 only.

The Inspector reports that he found many dead trees in the Central District of the Province and that the villages near Bukit Mertajam were infested with beetles.

Appendix B and C summarizes the work done during the year and shews the expenditure respectively.

General.

16. The year under review is remarkable for two events.

1st:—The decision of the Municipal Commissioners not to apply for the site of the Waterfall Gardens for making an impounding reservoir and 2nd:—The Agricultural Show. As regards the 1st. this decision was arrived at late in the year and it need hardly be said was a great relief, at last to know something definite, for it will be remembered that for the past three years this uncertainty has hung over us and paralyzed our work. It was obviously useless to go on with any fresh work knowing that the possibility of having to clear out at any time might happen. It will now be possible to take up several much needed improvements.

17. The second event of importance was the Agricultural Show which was held in Penang in August last and which might be said was under the auspices of this

Department. As separate Reports have been submitted on this matter it will be sufficient to say briefly that it is admitted to have been biggest and most successful Show ever seen in the Straits Settlements. The fact that, there were 1541 Exhibitors and no less than 20,000 exhibits shown will give some idea of the amount of work thrown on myself as Honorary General Secretary in particular and this Department in general. Indeed it not too much to say that more than half my time of the year under review was taken up by work in connection with the Show.

18. In July, I reported on a Scheme for re-afforesting the catchment area supplying the Bukit Mertajam reservoir and submitted an Estimate of cost for carrying it out. This has received the sanction of the Government and the work will be started early in 1906.

The Municipality were engaged for some weeks fitting a Venturi water Meter on the 24" main pipe in the Gardens and connecting it with an automatic recorder which was placed in a small building erected to receive it at the back of the Garden's Office. The necessary openings to get at the main have been screened by suitable plants.

Expenditure.

19. The total amount of Government Grants under the heading of Botanic Gardens amounted to \$7,600 of which \$7,420.98 was expended, particulars of which are given in Appendix C.

W. FOX,

Supt. of Botanic Gardens.

APPENDIX A.

Date of Tapping, 1905.	Weight of dry Rubber obtained at each operation, in ounces.														Total weight of wet Rubber.		Weight when dry.		REMARKS.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lbs.	oz.	lbs.	oz.	
From 2nd December to 28th December ...	$\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{3}{4}$	3	$3\frac{3}{4}$	4	5	5	$6\frac{1}{4}$	$6\frac{1}{2}$	$7\frac{1}{4}$	$11\frac{3}{4}$	$9\frac{3}{4}$	$8\frac{1}{4}$			4	$12\frac{1}{4}$	

APPENDIX B.

Name of District.	No. of Coco-nut trunks destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summons issued.	Amount of Fines recovered.	REMARKS.
Province Wellesley, Northern District.	414	1,568	104	54	232	7	\$ 12 00	and costs \$3 50.
Province Wellesley, Central District.	350	755	98	61	174	5	18 00	and costs \$2 50.
Province Wellesley, Southern District.	92	470	99	140	151	Nil	Nil.	
Penang Island.	428	2,299	790	55	466	11	15 00	and costs \$4 50.
Total.	1,284	4,692	1,091	310	1,023	23	45 00	

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT,
PENANG, DURING THE YEAR 1905.

Item of Estimate.	Grant ac- cording to Printed Estimates 1905.	Extended during the year 1905.	Total Grant for 1905.	Total Ex- penditure for 1905.	Balance on 31st Dec., 1905.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	4,776 00	..	4,776 00	4,270 00	506 00
2.—Expenses of carrying out the Provision of Coco-nut Trees Preservation Ordin- ance ...	300 00	...	300 00	298 02	1 98
3.—Maintenance of Waterfall Gardens...	4,960 00	...	4,960 00	4,953 66	6 34
4.—Purchase of Books and Periodicals ...	100 00	...	100 00	91 65	8 35
5.—Travelling and Per- sonal Allowance ...	440 00	...	440 00	288 04	151 96
6.—Up-keep of Grounds of Governor's Hill Bungalow ...	1,800 00	...	1,800 00	1,789 61	10 39
Total ...	12,376 00	...	12,376 00	11,690 98	685 02

W. FOX,

Superintendent of Forests and Gardens.

APPENDIX C.

REVENUE AND EXPENDITURE OF THE BOTANIC GARDENS, PENANG, 1905.

REVENUE.	ESTIMATES.	EXPENDITURE.	
	\$ c.		\$ c.
<i>Government Grant.</i>		{ Wages	3,502 37
Maintenance of Water- fall Gardens ...	4,960 00	{ Store, Tools and Attaps ...	427 42
		{ Pots and Tubs ...	146 51
		{ Manure and Cartage ...	193 80
		{ Freight ...	56 82
		{ Chicks for Plant Sheds ...	79 43
		{ Miscellaneous & Petty Expenses	547 31
			4,953 66
		Balance	6 34
<i>Government Grant.</i>		Total	4,960 00
Upkeep of Grounds of Governor's Hill Bunga- low	1,800 00	{ Wages	1,516 86
		{ Tools and Attaps ...	117 47
		{ Manure	66 10
		{ Vegetable Seeds ...	18 38
		{ Flower Pots	35 80
		{ Miscellaneous	35 00
			1,789 61
		Balance	10 39
<i>Government Grant.</i>		Total	1,800 00
Travelling and Personal Allowance ...	440 00	{ Pony Allowance	240 00
		{ Passages and Field Allowance...	48 04
			288 04
<i>Government Grant.</i>		Balance	151 96
Expenses of carrying out the Provisions of Coco- nut trees Preservation Ordinance ...	300 00	Total	440 00
		{ Allowance to Inspector of Coco- nut trees	240 00
		{ Destruction of dead Coco-nut trees... ..	58 02
			298 02
		Balance	1 98
<i>Government Grant.</i>		Total	300 00
Purchase of Books and Periodicals ...	100 00	{ Books and Periodicals ...	91 65
		{ Balance	8 35
Total Government Grant	7,600 00	Total	100 00

	\$ c.
Revenue from Plant Sales ...	566 80
Do. Swimming Bath ...	8 10
Total collected ...	574 90

W. FOX,
Superintendent of Forests and Gardens.

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS

SINGAPORE AND PENANG,

FOR THE YEAR

1906

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.

Singapore:

KELLY & WALSH, LIMITED, PRINTERS,
32 Raffles Place & 194 Orchard Road.

1907.

Annual Report of the Botanic Gardens, Singapore and Penang, for the Year 1906.

Staff.

1.—There was no change in the Staff during the year, except that an apprentice Sub-Overseer, by name of SILVESTER PAUL, was taken on in May. The Superintendent of Penang went on sick leave for a year, in March, and it was suggested that the Assistant Superintendent of the Singapore Gardens should take his place during his absence as has had to be the system previously, but, in view of the Agricultural Exhibition in August, and the heavy increase of work of the department due to the rapid development of the agriculture of the Peninsula of late years, it was found impracticable to reduce the staff to the Director only, so that Mr. PEEL (Ag. Collector of Land Revenue) superintended the work of the Penang Gardens. The Clerk of the Department, Mr. J. S. ISAAC, and the Artist, Mr. C. DE ALWIS, were on leave for three months each during the year. The coolies were as poor a lot as ever, the demand for labour on estates at higher wages than is allowed for the Botanic Gardens made it impossible to secure men other than sickly and worn-out labourers rejected by planters.

Visitors.

2.—A very large number of visitors, sometimes as many as six in a morning, came during the year to consult the Director, chiefly on the subject of rubber planting. The opening up of the Federated Malay States, due to the immense development of rubber cultivation, has immensely increased the number of visitors to the Garden in search of information, and has equally increased the correspondence of the department, and the prospective opening up of the territory of Johore which will follow on the completion of the railway will, without doubt, largely increase the work in the near future.

Among the more important scientists, agriculturists and others who visited the Gardens and spent some time there were P. OLSON-SEFFER (Mexico), Dr. SCHLECHTER, Dr. DEISLER, Mr. UNGER (Yokohama), Professor CAMPBELL (Stanford University, U.S.A.), Mr. SHAW-HELLIER (Jamaica), Mr. A. W. PRAUTCH (Manila), Mr. RYAN (Ceylon), Mr. TAUPIN (Madagascar), Dr. A. H. SUGGETT (Mexico), Mr. H. PRICE (Boston, U.S.A.), Mr. BIENENFELS (San Francisco), M. VERNET, Dr. WEGENER (Berlin), H. H. PRINCE YUGALA (Siam).

Thefts.

3.—The most important theft during the year was of five hundred rubber seedlings by natives at night from the Economic Gardens. Very extensive thefts had occurred of this nature all over the Peninsula, and seedlings were being shipped in vast quantities to Dutch Borneo. A Malay was arrested with a large number of the source of which he could give no credible account, but the case against him was not considered sufficiently clear so that it was dismissed. A Chinaman was caught in the evening collecting *Wormia* leaves, and fined five dollars, and there were a few thefts of flowers, fruit, etc., of the usual style.

The regulations as to dogs admitted to the Gardens when led by a string only having been allowed to be relaxed somewhat, as has previously happened, certain visitors brought dogs under no control which did damage in the Gardens, and the rule had to be strictly enforced again, and some little trouble was caused by thoughtless riders galloping their horses on the turf and spoiling it.

Roads and Drives.

4.—The exceptional humidity of the year caused much damage to the Garden drives, and the following urgently needed repairs were executed and paid for out of the Gardens Vote.

The drive from the top of the plant house to the cross ways below the band-stand was remetalled with three inches of laterite, gravelled and rolled, being of length of 200 yards and width of 11 feet.

The drive from the terrace steps to the cross ways by the end of the red-stemmed palm avenue was remetalled with three inches of laterite, gravelled and rolled for a length of 80 yards by 18 feet width.

The road from the godown to the plant house was remetalled with three inches of laterite, gravelled and consolidated for 95 yards and 11 ft. width.

The four-foot way from the main entrance to the drive near the old aviary was regavelled for 135 yards.

The road from Garden Road to the officers' quarters was remetalled with three inches of aterite, gravelled and consolidated for 200 yards and 15 ft. in width, and re-gravelled for 97 yards.

The main drive from the office to the band-stand, which is steep and had scoured, was patched to a considerable extent.

The Garden road of a length of nearly five hundred yards, running from Tyersall Road to Dalvey Road, was remetalled by the Public Works Department.

Drains and Culverts.

5.—A mason and coolie were employed nearly the whole year in patching and renewing urgently needed work. Two small drains with cemented catchpits were made across the road between the plant houses and godown. The side drains from terrace steps towards the old aviary for 75 yards length and 6-7 inches wide were renewed.

The side drains along the four-foot path from the main entrance to the old aviary were patched and repaired. The side drain from the main entrance along the drive for 295 yards was renewed. The large culvert near the officers' quarters was lengthened and a new catchpit made. The cement paths in the plant-house and sheds were repaired and as much of the old aviary demolished as time allowed, the bricks being used for repairs. The unsightly culverts on the band-stand paths have been renewed and lowered so as to admit of a regular even path, and at the same time the side drains on both sides of the path for 40 yards on each side were renewed. The drain on one side of the main drive from the plant-house steps to the band-stand has been deepened and renewed for a distance of 90 yards.

New or Noteworthy Plants.

6.—Among the more interesting novelties which flowered during the year were:—

Malayan :—*Didymocarpus perdita*.—(Pulau Battam).

Vanda hastifera.—(Borneo).

Aeschynanthus tricolor.—(Borneo).

Aeschynanthus Lobbiana var?—(Borneo).

Habenaria xanthocheila.—(Penang).

Gastrochilus pulchellus n. sp.—(Borneo).

Globba brachyanthera.—(Borneo).

Clerodendron n. sp.—(Borneo).

Begonia oblongifolia.—(Borneo).

Begonia promethea.—(Borneo).

Peperomia n. sp.—(Borneo).

Hapaline appendiculata n. sp.—(Borneo).

Schismatoglottis brevipes.—(Perak).

Medinilla speciosa.—(Selangor).

Tacca vespertilio n. sp.—(Perak).

Tacca minor.—(Kelantan).

Strophanthus Jackianus.—(Sumatra).

Ceratolobus laevigatus.—(Perak).

Cypripedium glaucophyllum.—(Java).

Saccolabium sp. new.—(Perak).

Siam :—*Ancilema sinicum*.

Habenaria geniculata.—(Shan States).

Ruellia sp.

China :—*Lycoris radiata*.

Licuala peltata.

Christmas Island :—*Abutilon Listeri*.

A. auritum.

Africa :—*Tinnæa aethiopica*.

Cyrtum sp. Accra.

Culcasia Manii.—(Flowers and fruits).

Amaryllis Bellandonna.

Sansevieria grandicuspis.

Madagascar :—*Brexia madagascariensis*.

South America :—*Pitcairnea andreaana*.

Solanum rubrum.

Solanum Lobelii.

Solanum texanum var *tricolor*.

Salvia hispanica.—(Cuba).

Sagittaria natans.

Utricularia sp.

Dracontium polyphyllum.

Garden origin :—*Crinum hybrid*.—(Todaro).

Crinum Northianum—fruited for the first time, the fruit being hitherto unknown.

The water lilies in the lake were propagated and made a fine show throughout the year, and a number of new kinds were introduced. There was a good exhibition of Gloxinias for most of the year, some very fine strains having been obtained. The Gramatophyllums in the Gardens did not flower at their usual time in August and September, but commenced flowering in December.

New Plants Introduced.

7.—Among the new plants of interest introduced were Palms, *Cocos datil*, *Yatay*, *Calamus paspalanthus*, *Demonorops propinqua*, *Gaussia princeps*, *Copernicia* 3 species, *Areca flammula*, *Roscheria melano*, *Choetes*. Among Ferns, *Aspidium erythrosorum*, *A. descursivopinnatum* and *viridescens*, *Sophoroids*, *Gymnogramme lottia*, and *Lygodium japonica* from Japan. A collection of succulents from Hamburg, and additional set of *Nymphaeas* and *Cyperus papyrus* from Dreer of Philadelphia, and a collection of the *Yautias* (Keladi) of Cuba.

Plants Received.

8.—During the year 6,371 plants and 438 packets of seeds were received, beside the usual stock of flower seeds purchased. The donors were :—

Messrs. GIBBS, STEPHENS, ST. V. B. DOWN, CHOA KIM KEAT, MICHOLOITZ, HOE ENG WATT, VON USLAR, LOHER, P. S. FALSHAW, M. LAURENT, SNOW, BEAUCLERK, COL. POWER, R. LITTLE, DR. GIMLETTE, BIDWILL, J. C. HARVEY, E. M. HOLMES, PROFESSOR SARGENT, DR. SCHLECHTER, BOEHMER & CO., SANDERS & CO., HERB & CO., DANMAN & CO., DREER & CO., and the Botanic Gardens of Saigon, British Guiana, Baroda, Cuba, Rangoon, Berlin, Trinidad, Guiana, Madras, Washington, Sydney, Annam, Hamburg, Arnold Arboretum, Nogent sur Maine, Hanoi, and Philadelphia.

Export.

9.—There were, excluding Para Rubber plants and seeds, 1,964 plants and 314 lots of seeds exported. The recipients were Dr. PREUSS, Chief Surgeon, Luang, Prabang, Mr. J. HARVEY, Mr. A. D. MACHADO, Mr. WOODFORD (Solomon Islands), Mr. DREER, Mr. CHOA KIM KEAT, Mr. CHATTERJEE, Messrs. SANDERS & Co., Mr. HOE ENG WATT, Col. POWER, Mr. BEAUCLERK, Mr. HEWITT, Mr. TAUPIN, Mr. ABRAHAMS, Mr. WILLIAMS, Mr. DOWN, Mr. BIRD, Messrs. DANMAN & Co., Mr. J. D. PEREIRA, Mr. RANKIN, Mr. GOODFELLOW, the Botanic establishments of Sydney, Jamaica, New Guinea, Penang, Teynampett, Christmas Island, Hamburg, Washington, Trinidad, Melbourne, British Guiana, Port Darwin, Fiji, Kew, Cuba, Thaiping, Berlin, Hanoi, S. Nigeria, as well as the Royal Engineers Hospital, Blakan Mati, Pulau Pisang and Raffles Lighthouses, General Hospital, Government House, P.W.D. Grounds, Forest Department, F.M.S., Residency Malacca, Ordinance Office Pulau Brani, Kandang Kerbau Hospital, Colonial Secretary's Bungalow, etc.

Herbarium.

10.—As it was impossible for the Director to make any expeditions this year, except one to Malacca and Province Wellesley, no great amount of collecting could be done. A large collection of herbarium was received from the Manila Botanic Gardens, and a large number from the Buitenzorg Gardens. Indian and Philippine plants were received from the British Museum, and specimens were received from Kelantan from Dr. GIMLETTE, and from Selangor by Mr. A. M. BURN-MURDOCK, who also sent some wood specimens and two cases of plants collected by Mr. Fox and the Forest Officers in Lankawi and Penang. Specimens from Southern Siam were received from Mr. Down, and a number of interesting plants from Sarawak collected by Mr. HEWITT.

Five hundred and eighty-three specimens were sent to Kew, and a case containing a five-stemmed Betel-Nut Palm and other specimens of climbers, etc., 472 specimens to Mr. YUSUN KUDO of Japan in exchange for plants previously received, 153 to the British Museum, 386 to Manila, 156 to Dr. TRELEASE of Missouri, 24 specimens of Palms to Dr. BECCARI, 238 specimens to Professor SARGENT, Arnold Arboretum, 238 to the Botanic Gardens, Calcutta, 164 to Sydney, and 90 to West Australia.

Additional glass cases were obtained and a series of Dammars, Rubbers and Gutta Perchas arranged and labelled. A fine collection of Dammars from the Moluccas, named and priced, was presented by Mr. W. D. DIEPENHEIM, who also presented a collection of Oils Tea, Spices, Sugars and other Economic produce from the Eastern Islands.

Library.

II.—The following books and pamphlets were received during the year:—

- BURKILL, T. H.—*Gentianarum species Asiaticæ*.
 „ *Swertia angustifolia*.
 „ *Parasite upon a Parasite*.
 MAIDEN, J. H.—*Useful Australian Plants*.
 „ *Weeds of New South Wales*.
 „ *Allium fragrans*.
 SARGENT & PECK—*Cratægus species, of Albany*.
 ALBERT, F.—*El Cultivo del Olivo*.
 „ *El Karri e Eucalyptus diversicolor*.
 „ *Los Servicios de Aguas e Bosques*.
 CLARKE, C. B.—*New Philippine Acantheaceæ*.
 ELMER, A. D. E.—*Leaflets on Philippine Botany "Rubiaceæ"*.
 „ *A Fascicle of Benguet figs*.
 „ *Additional New Species of Rubiaceæ*.
 „ *Pandanus of East Leyte*.
 AHERN, Capt. G. P.—*Notes on India Rubber and Gutta Percha*.
 „ *Charcoal Industry in the Philippines*.
 „ *Annual Report on the Philippine Forests*.
 CASTILLO, LIUS.—*La Caza de la Ballena*.
 MERRITT, M. L. & WHITEFORD—*A Preliminary Working Plan for the Forests of the Philippines*.
 GARDNER, R.—*Mechanical Tests of Thirty Philippine Woods*.
 FAIRCHILD, D.—*Our Plant Immigrants*.
 LIPPINCOTT, J. B.—*The Yuma Reclamation*.
 HENRICKSEN, H. C.—*Vegetable Growing in Porto Rico*.
 PIPER, C.—*Contribution X from the National Herbarium*.
 KRAMER, H.—*Origin and Nature of Color in Plants*.
 BREDÁ, DE HAAN.—*Report on Arachis hypogæa*.
 CRAMER, P.—*Report on Cassava*.
 CHRIST, H.—*Filices Insularum Philippinarum*.
 „ *Filices Cavalerianæ*.
 LENDENFELDT—*Relation of Wing Surface to Weight*.
 NEWELL, T. H.—*The Work of the Reclamation Service*.
 MACGREGOR, K., & WORCESTER, D. C.—*List of the Birds of the Philippine Islands*.
 HULLETT, R. W.—*Presented 5 Volumes of the Transactions of the Linnean Society*.
 WRIGHT, H.—*Hevea Braziliensis, Editions 1 & 2*.
 WILLIS, J. C.—*Rubber in the East*.

Also the usual series of Journals, Reports and other publications of the various Botanic and other Establishments of the world.

Purchased:—*Le Caoutchouc en Indo-Chine* by C. & A. SPIRE.

The Gardeners' Chronicle, Botanical Magazine, Journal of Linnean Society, Indian Planting and Gardening, India Rubber and Gutta Percha Trades Journal, and Pflanzenreich.

Publications.

12.—The printing of the Volumes on Monocotyledons for the Materials for "A Flora of the Malay Peninsula" was commenced, and is expected to appear in a month or two. They are divided into two volumes, which are being printed simultaneously. The first volume contains the Hydrocharideæ and Orchideæ, the second the rest of the orders. Papers on the Begonias and on the Scitamineæ and the Grasses and Sedges of Borneo and a complete account of the expedition to Christmas Islands and the Flora thereof were published in the "Journal of the Straits Branch of The Royal Asiatic Society" by the Director, and also an article on the Scitamineæ of the Philippines, published in a Manila Journal. All the types of the species described are conserved in the Botanic Gardens, Herbarium.

The "Agricultural Bulletin" was published as regularly as could be done by the printers, and there was no falling off in the demand for it. Mr. J. B. CARRUTHERS became assistant Editor in the beginning of the year. Most of the articles dealt with Rubber cultivation and manufacture, but fibres, oil-grasses and other subjects were treated of. The article on Malayan drugs, printed many years ago in the "Straits Medical Journal" by the Director, and long unprocurable, was reprinted and very much augmented. Investigations were also made into the action of copper sulphate on water weeds, and especially on the laterite-forming Bacterium Crenothrix, and an account published in the Bulletin.

The Artist continued making drawings of important plants, and towards the end of the year, in the rainy season, made a large series of drawing of the soft Fungi, of which little or nothing is at present known, and which are almost impossible to preserve even in alcohol in this country, so that coloured drawings are the only way of recording and identifying them satisfactorily. Of a few drawings sent previously to Kew of these plants all proved to be unknown previously to science. A few more supplementary lecture diagrams were also made by the Artist. The lectures to the Medical Students were delivered by the Director from September to December twice a week, as on the previous occasion.

Agri-Horticultural Show.

13.—The Annual Exhibition was held this year at Singapore, and was probably the largest Exhibition of the kind ever held in the East. The exhibits from all parts of the Peninsula were remarkably good on the whole, and the Exhibition was attended by very large crowds of visitors and some delegates from Java, India, Ceylon, Burmah and other places. The secretarial work of the Exhibition, which was very heavy, was effected by the Director and Mr. J. S. ISAAC, Clerk of the Botanic Gardens Department.

Economic Garden.

14.—This part of the Gardens has steadily increased in usefulness and importance, not only to the local community, but to all the tropical parts of the Empire, and indeed it would be difficult to over-estimate its utility. All tropical plants are experimented with and stocks of all for which there is or is likely to be an exceptional demand are maintained in considerable quantities. It may give some idea of the work carried out if it is mentioned that during the year plants or seeds have been despatched on sale to countries as remote as the West Indies, including Cuba, Samoa, Honolulu, Queensland, New South Wales, West Australia, Fiji Islands, Philippines, New Guinea, China, Hongkong, Borneo, Sumatra, Java, India, Ceylon, Egypt, Lagos, Nigeria, and Madeira, while the local demand from the Colony and Federated Malay States has increased enormously.

Apart from the ordinary interchange between gardens, so greatly has the work increased that the addition of five men has been sanctioned for the new year. At the present time the labour employed is quite inadequate for the due maintenance of the garden, nor is it possible, even at a time when agriculture is developing in the Peninsula at such a rate, to carry out experiments which are urgently required. A request for an additional assistant so as to put the Gardens of the Straits Settlements on the level in staff of some, at least, of the smaller Gardens of the other Colonies was inserted in the Estimates for the next year, but circumstances prevented this addition to the staff being made.

The keen demand for Para rubber seed from the Garden trees necessitated the frequent mowing and cleaning of the ground and drains so as to procure every possible seed, and as this part of the Garden is hardly above sea-level and the ground frequently flooded the growth of the weeds is very rapid. Watchmen have had to be employed too to prevent the seeds and plants in the nurseries from raiders. The largest undertaking in this Garden, apart from the routine and urgent work, during the year consisted in digging the young Rubber ground formerly under grass three times over so as to thoroughly eradicate the grass and weeds. The plot is 300 yards long and 120 yards wide, and when it had been thoroughly cleaned and was sufficiently dry it was planted up in blocks with Tapioca, Ground-nuts, Ramie, Lemon Grass, Citronella and Cus-Cus. Hitherto it had been impossible to grow the rubber trees here on account of a plague of brown slugs which, concealed by day in the

grass weeds, attacked the buds of the rubber by night preventing its growth. The result of this cultivation of catch-crops between the young rubber has been the extermination of this pest, and the growth of the young plants very satisfactory.

The question of catch-crops for rubber has been one of the most important ones of the year, and is the subject of a large quantity of the garden correspondence. It is regrettable that the paucity of the staff prevents time being given to experiments on this subject carried out as they should be.

A good deal of Colonial interest during the past two years has been taken in fibres of all sorts, and the plot of land opened last year has been maintained and large stocks of the most likely fibres for cultivation here have been raised.

Among the most free-growing fibres as judged by its strong development of leaves is *Sansevieria guineensis*. *S. zeylanica* has grown well also, but is not quite so quick in supplying a good stock of leaves. *S. sulcata* and *S. cylindrica* have proved healthy, but, though furnishing the largest supply of fibre for the leaf and being the easiest to handle for machine work, are unfortunately too slow as a catch-crop in this country.

Mauritius hemp grows well in ordinary soils. Sisal hemp has been kept under observation, but does not seem to do well; it is essentially a plant for dry sandy loose soil.

The Coffee and Rambong ground has been well maintained. No part of the Gardens is well suited to these plants, but for the purpose of meeting the demand for Rambong (*Ficus elastica*) cuttings it has been possible to produce 150 rooted cuttings by marcotting, and though the parents may never develop into robust plants they will serve as stock plants. The demand is chiefly, however, for seed and seedlings, and a strong batch of seedlings raised here were disposed of through the year.

Export of Para Rubber Seed.

15.—During the year a very large number of Para Rubber seeds and plants were sent out to all parts of the world, of these a large number were supplied from the Botanic Garden trees, others were obtained outside from various plantations and packed and shipped. The packing of these seeds for long distances entailed a great amount of work, as they had to be packed in tin boxes, 150 seeds in a tin with burnt rice dust. Two tins were then enclosed in a canvas covering, addressed, and then sent by post, so as to avoid the seeds being heated in the hold. This plan has been proved eminently successful, and the percentage of seed that arrived safely at long distances such as Jamaica, Solomon Islands, West Africa, etc., has been very high.

The following were the localities to which the seeds were sent :—

Seeds from the Economic Garden Trees.

Singapore	...	...	...	...	15,510
Province Wellesley and Perak	...	...	...	...	48,950
Selangor...	...	...	...	...	80,795
Christmas Island	...	...	...	...	2,400
Borneo	...	...	...	...	100
British Solomon Islands	...	...	...	...	600
British Guiana	...	...	...	...	2,100
Queensland	...	...	...	...	150
Philippine Islands	...	...	...	...	500
Honolulu	...	...	...	...	800
Mexico	...	...	...	...	900
Sumatra...	...	...	...	...	2,000
Uncertain destination	...	...	...	...	2,800
Total					157,605

**Seeds Purchased elsewhere, Packed and Shipped
at the Botanic Gardens.**

Jamaica	...	...	...	...	200,000
Lagos and Nigeria	...	...	...	...	80,000
Pahang	...	...	...	...	43,000
Sumatra	...	...	...	...	10,000
Kelantan	...	...	...	...	7,000
Borneo	...	...	...	...	300
					345,300

Total number of seeds exported 502,905.

A larger number of seedlings also were exported, viz:—

Singapore...	...	...	...	...	3,200
Borneo	...	...	...	...	8,050
Sumatra	...	...	...	...	3,200
Uncertain destination	...	...	...	...	100
					14,350

It is gratifying to note that far the larger portion of these seeds have gone to various parts of the British Empire, and only comparatively few to other countries.

Other Plants Exported.

Ficus elastica is less in demand, and only 510 plants were exported this year to Sydney. A large number of seeds were exported to Southern Nigeria, 1,000 Coconuts were purchased and packed and transmitted there, and several bags of Nipa seeds and of Sago seed. These are reported to have arrived in good condition. Mangosteen and Durian seed were also sent. The latter is especially a bad traveller, as the seed is very fleshy and soon spoils.

Experiments on Rubber Tapping.

16.—A series of experiments were carried out through the year to test the effect of tapping at all seasons of the year, and a special and full report was sent to the Government on the result. There was a vote of \$1,200 allowed for these experiments, which actually cost \$1,178.50. This vote was refunded to the Government from the money received by the sale of the rubber made during the experiments, which amounted to \$2,600.41, so that the experiments cost the Colony nothing at all. A quantity of Latex was supplied to the Agricultural Exhibition to make into Crepe with a Crepe Machine, and a quantity of rubber in different forms sent to the Exhibition in Ceylon.

Inspection of Coconut Trees.

17.—Notices were served on 192 persons during the year, and 720 dead trees, 294 stumps, and 60 piles of rubbish likely to harbour beetles or already containing them were destroyed. There were no prosecutions.

					\$	c.
Vote for the year	...	...	...	...	210	00
Expenditure	...	...	...	...	193	64
Balance	...	...	...	...	16	36

HENRY N. RIDLEY,
Director of Gardens, S. S.

BOTANIC GARDENS,
Singapore, February 23, 1907.

The following details of Revenue and Expenditure are appended. It is noticeable that there is a balance of \$1,875.74 at the end of the year, which requires explanation. The annual vote supplied by the Government is not adequate for the expenses of the Gardens, and one-third of the cost is made on sales, and, as the money for the sales does not come in till late in the year, it is essential to keep a strong balance for the early part of the following year.

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS FOR 1906.

RECEIPTS.		EXPENDITURE.	
	\$ cts.		\$ cts.
By Balance in Bank on 1st January 1907	1,261 03	Wages of Coolies	5,939 09
Government Grant for the year 1906	8,000 00	Petty Expenses and Assistant Superintendent's Transport ...	910 26
By Sale of Economic Plants and Seeds and Revenue Recovered	8,037 71	Cartage	1,022 65
By Sale of Ornamental Plants and Seeds	1,270 52	Laterite (181 cubic yards) ...	398 20
Interest on the above	30 28	Gravel (129 cubic yards) ...	219 30
		Manure (61 cubic yards) ...	76 25
		Sand (46 cubic yards) ...	73 60
		Purchase of Plants and Seeds ...	1,803 37
		Telephone	90 00
		Methylated Spirit, Jeye's, etc. ...	44 55
		Timber and Planks	528 02
		Pots and Tubs	517 79
		Cloth for Packing Parcels ...	127 25
		Tools and Stores	958 05
		New Wardian Cases	194 00
		Books and Papers	292 09
		Freight and Postage on Plants and Seeds sent out	2,979 32
		Uniforms	47 25
		Packing Tins	161 00
		Lime and Bricks	164 19
		Purchase of New Safe	179 40
		Miscellaneous	60 65
		Balance in Bank on 31st December 1906	1,875 74
Total ...	\$18,599 54	Total ...	\$18,599 54

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT, SINGAPORE, DURING THE YEAR 1906.

ITEMS OF ESTIMATES.	GOVT. GRANT.	EXPENDITURE.	BALANCE.
	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	12,864 00	11,906 07	975 93
OTHER CHARGES.			
2.—Expenses of carrying out the Provisions of the Coconut Trees Preservation Ordinance	210 00	206 70	3 30
3.—Expenses in Connection with the Publication of the "Agricultural Bulletin" ...	300 00	300 00	—
4.—Expenses of Carrying out Experimental Rubber Tapping	1,200 00	1,191 50	8 50
5.—Grant to Botanic Gardens	18,599 54	16,723 80	1,875 74
6.—Travelling and Personal allowance ...	500 00	384 65	115 33
SPECIAL EXPENDITURE.			
7.—Furniture for Herbarium	1,000 00	1,000 00	... ..

Botanic Gardens, Penang.

Staff.

1.—Mr. Fox went on leave on March 23rd, and there being no Officer of the Department available to take his place, I was placed in temporary charge in addition to my other duties.

This arrangement continued during the remainder of the year, but it could hardly be considered satisfactory.

The Overseer, MAHOMED HANIFF, looked after the technical work and did it extremely well; the Gardens were kept by him in excellent order, but in the absence of a properly qualified European, scientific research made little or no progress.

In addition to this the Clerk was transferred and a new man with no experience of the work took his place.

The Inspector under the Coconut Trees Preservation Ordinance and the Mandor on the Hill died during the year.

Buildings and Upkeep.

2.—The office ceiling partially collapsed and it was found necessary to make immediate repairs. So much damage had been done in the past to the wood flooring by white ants that it was decided to put in a cement flooring. A special vote of \$1,500 was granted by Government and this work was carried out. The roof of the building was raised and the whole structure generally improved.

In the plant houses the atap roofing was replaced by ruberoid, which has proved quite satisfactory and is more lasting.

In several of the houses the tables were cemented as a means of keeping away the white ants.

The roads were kept in good repair and the general condition of the grounds and buildings reflects great credit on the Overseer in charge.

The new rockery near the stream below the wooden rustic bridge was practically completed. A large number of ferns have been placed there, and a large specimen of the *Impatiens Mirabilis* or Gouty Balsam obtained from the Langkawi Islands added.

This rockery forms a very pleasant addition to the Gardens.

Plants.

3.—No new variety of plant was added to the Gardens during the year. The Overseer, however, performed several grafting experiments.

The grafting of the well known "La France" rose on the common local variety proved a success, a fine rose with a most delicate odour being obtained. Some interesting results were also obtained by grafting the violet *Allamanda* on the yellow variety.

A visit was paid to the Langkawi Islands in August, when a number of orchids and another specimen of the *Impatiens Mirabilis* were obtained.

A number of plants were supplied to the Government Plantations, Perak, and some promised in return from the Taiping Hills.

Plant sales, exclusive of \$74.25 received for rubber seeds, realised \$319.25 as against \$566.80 in 1905. This falling off was mainly due to the fact that certain restrictions were placed on the sales owing to there being no European in regular attendance at the Gardens.

Publications.

4.—The usual periodicals were received during the year, and an interesting work presented by Messrs. VEITCH and SONS containing a good deal of useful information especially with regard to varieties of Orchids.

Para Rubber.

5.—The old Para Rubber tree at the Gardens was tapped in November and December and 4 lb. 4½ oz. of dry rubber obtained; this makes a total of 35 lb. 13½ oz. from the tree since it was first tapped. The tree reached the height of its production in 1905 when 4 lb. 12½ oz. of rubber were obtained. The upper branches are beginning to wither and there is little doubt that it will now deteriorate. Although the Experimental Garden on Penang Hill has been abandoned and is now partially covered with secondary growth, experiments were made on four of the Para Rubber trees standing there. As the altitude is about 2,000 feet the results were interesting. The age of the trees was about 12 years and the total dried rubber obtained 6 lb. 6 oz. Appendix A. gives the results of the various tappings.

If proper implements for tapping the trees and drying the rubber were obtained, it might be of advantage to systematically tap all these trees as well as those in the Botanic Gardens themselves, where 21 trees exist ready for tapping. 3,600 rubber seeds were sold from the Gardens during the year for \$74.25, the price ranging from \$20 to \$7.50 per thousand.

Penang Hill.

6.—The coolies employed in the compound of the Governor's Hill Bungalow and the vegetable gardens were placed under the charge of Mr. FERNANDO, the Public Works Overseer on the Hill. The supervision was infinitely better than it had been for the previous two or three years, and the gardens gave evidence of increased industry on the part of the coolies. That this increased industry was not spontaneous was evident from the fact that several complaints were received from the coolies regarding the increased severity of the tasks they were called on to perform.

A new additional vegetable garden was started just below Belle Vue Bungalow and has proved a success.

Preservation of Coconut Trees.

7.—Owing to the death of Mr. BALHATCHET the returns for the first four months of the year could not be found.

The number of notices issued during the last eight months of the year in Penang and Province Wellesley was 450.

There were 13 prosecutions in Penang, 12 convictions being obtained; the fines realised amounted to \$40.

Appendix B. summarises the work done under this head. The fines inflicted by the Magistrates for breaches of this Ordinance are so small that they do not act as a sufficient deterrent.

General.

8.—As Honorary Secretary for Penang, I attended the Agri-Horticultural Show at Singapore in August. A fair number of exhibits were taken from Penang and a large proportion of prizes obtained, including the cup for the best collection of fruits and the first prize for the best Palm.

9.—The weather during the year was more irregular than usual; rain fell incessantly during the first eight days of November, while the fall in December was unusually high.

The total rainfall on the Hill was 123.79 inches, and at the Gaol 112 inches, as against 100.9 inches and 78.31 inches respectively in 1905. The latter year was, however, an exceptionally dry one.

10.—Nothing further was said regarding the proposal to make a large impounding reservoir on the site of the Gardens, and it is hoped that the necessity for it may not arise.

The Municipal Commissioners acquired a large tract of land above the waterfall for the purpose of improving the present Catchment Area.

Expenditure.

11.—The usual statement of expenditure is to be found in Appendix C.

W. PEEL,

Acting Superintendent of Gardens.

APPENDIX A.

Date of Tapping, 1906.	Weight of dry Rubber obtained at each operation in ounces.														Total weight of dry Rubber		REMARKS.		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lb.	oz.			
I.—Old Tree in Botanic Gardens:—																			
From 19th November to 15th December ...	$\frac{3}{4}$	4	$6\frac{1}{4}$	$4\frac{3}{4}$	$5\frac{1}{2}$	$6\frac{1}{2}$	6	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{4}$	4	4	4	$3\frac{1}{2}$	4	$4\frac{1}{2}$			
II.—Trees on Penang Hill:—																			
From 11th July to 6th August	...	a	$\frac{3}{4}$	$1\frac{1}{4}$	2	$1\frac{1}{4}$	$2\frac{1}{2}$	1	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{1}{2}$	$1\frac{1}{2}$	1	$4\frac{1}{4}$		
		b	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	1	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$...	$11\frac{1}{2}$	
		c	$\frac{3}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	$2\frac{1}{2}$	2	$1\frac{1}{2}$	$2\frac{3}{4}$	1	$8\frac{1}{4}$	
		d	$1\frac{1}{4}$	$1\frac{1}{4}$	2	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{4}$	4	4	$3\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	6	$3\frac{1}{2}$	2	14	

NOTE :—Two and a half ounces of scrap were collected from the tree in the Gardens, and five and a half ounces from the trees on the Hill.

W. PEEL,
Ag. Superintendent of Gardens.

APPENDIX B.

RETURN OF THE INSPECTOR OF COCONUT TREES FOR THE LAST 8 MONTHS OF THE YEAR 1906.

No. of Notices issued during the year from 1st May to 31 December.	No. of dead Coconut Trees destroyed.	No. of dead Coconut Trunks destroyed.	No. of heaps of Cattle dung destroyed.	No. of heaps of Paddy-husk destroyed.	Amount of Fines received.		REMARKS.
					\$	c.	
<i>Penang District :</i>							
250	166	816	179	2	40	00	13 Prosecutions. 12 Convicted. 1 Withdrawn.
<i>Northern District :</i>							
87	109	133	40	...	...	...
<i>Central District :</i>							
68	74	202	33	...	...	...
<i>Southern District :</i>							
45	52	116	43	...	...	...
450	401	1,267	295	2	40	00	

W. PEEL,
Ag. Superintendent of Gardens.

APPENDIX C.

EXPENDITURE OF THE BOTANIC GARDENS, PENANG.

GOVERNMENT GRANT.	ESTIMATED 1906.	EXPENDITURE.	
	\$ c.		\$ c.
Maintenance of Waterfall Gardens	4,960 00	{ Wages 3,752 04 Tools and Materials 111 31 Manure 188 00 Freight 9 00 Ruberoid Meranti Laths and Attaps for Plant Sheds 552 02 Flower Pots 88 54 Metal for Road 93 75 Miscellaneous and Petty Expenses 156 04 Balance 4,950 70 9 30 Total 4,960 00	
Upkeep of Grounds of Governor's Hill Bung- low	1,620 00	{ Wages 1,245 53 Tools and Materials 59 24 Vegetable Seeds 59 19 Manure 107 00 Flower Pots 37 50 For carrying Manure and Flower Pots to Hill Gardens 71 22 Miscellaneous and Petty Expenses... 5 99 Balance 1,585 67 34 33 Total 1,620 00	
Travelling and Personal Allowance	440 00	{ Pony Allowance 240 00 Sea and Field Allowance 140 70 Balance 380 70 59 30 Total 440 00	
Expenses of carrying out the Coconut Trees Pre- servation Ordinance ...	300 00	{ Allowance to Inspector of Coconut trees 234 84 Destruction of dead Coconut trees 63 72 Balance 298 56 1 44 Total 300 00	
Purchase of Books and Periodicals	100 00	Books and Periodicals 38 86 Balance 61 14 Total 100 00	

W. PEEL,

Ag. Superintendent of Gardens.

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command of
His Excellency the Governor.

Annual Report on the Botanic Gardens, Singapore, for the Year 1907.

Staff.

The Director went on nine months' leave from April 22nd, and Mr. FOX came from Penang to act in his absence on April 26th, Mr. R. DERRY replacing him in Penang. Mr. C. B. KLOSS, who was temporarily acting during the absence of the Assistant Superintendent in 1903, acted in a similar capacity from August to November 30th. The Artist Mr. C. DE ALWIS ceased work at the end of the year. There was a good deal of sickness among the coolies during the year, Diarrhoea, Fever and Beri-beri.

Visitors.

There was the usual number of ordinary visitors to the Gardens during the year, and among others, SIR NATHANIEL NATHAN, Dr. TREUB (Buitenzorg), Mr. KELWAY BAMBER (Ceylon), Mr. T. S. BURROUGHS, the Hon'ble STANFORTH SMITH, Director of Agriculture for Papua, Messrs. A. BRIZON and DUCHEMIN from Saigon, Dr. H. BRENIER (Sous-directeur de l'agriculture), Hanoi, and Professor J. PONCHAT, (Professeur d'agriculture and M. THIBAudeau), Administrateur de Hanoi, Tonkin, and many planters and others interested in agriculture.

Roads and Drives.

An extra vote of one thousand dollars allowed of a good deal of repairs and re-making of roads and drains. The long road from the main entrance to the Band-stand was re-metalled. The road from Office entrance to the Band-stand re-metalled. The roads on both sides of the Office and from the old aviary to the main road were re-metalled. The road behind the Band-stand leading to the Potting-shed was patched and repaired.

A new drain was built on four sides of the Garden Office leading to a tank for storage of water, and another on both sides of the road below the Band-stand leading to the plant houses was made. Guttering was supplied to the Garden Office.

Buildings.

The quarters of the Clerk and Foremen-Gardeners, and those of the Watchmen were re-attaped. A new store was built in the Economic Gardens, and new quarters for the Carpenters were built near the Godown. Two new latrines were built in the Cooly Lines. Old wooden stages for Orchids were replaced by bricks. The remainder of the old aviary buildings was cleared away, the ground dug and planted up and the old monkey cage repaired; painted and converted into a shelter. Repairs were also made to the ventilators of the Herbarium building.

The long proposed scheme for supplying water from the well and lake to various parts of the Garden was definitely commenced. A two horse-power oil engine was erected and a tank for the water was put up in the Garden jungle. The work was not finished by the end of the year. This will be an immense improvement to the Garden. The cost was paid from the money obtained by the sale of rubber made during the experiments.

New and Noteworthy Plants.

The following were among the most interesting plants which flowered or fruited for the first time in the Gardens:—

Heptapleurum tomentosum.—(Selangor).

Dendrocolla pardalis.—(Sarawak).

Schismatoglottis nervosus.—(Sarawak).

Curculigo racemosa.—(Sarawak).

Impatiens sp.—A very pretty dark pink balsam (Sumatra).

Scutellaria javanensis (Java).

Statice sinensis.

Lobelia nicotianæfolia.—(Ceylon).

Palicourea gar- enioides.

Bryonopsis laciniosa.

Randia sp.—Shrub with white flowers. (Madagascar).

Begonia Kewensis:

Clerodendron sp.—(*Cl. disparifolium* of Kew, but not the plant of the Malay Peninsula known by that name).

Gomphia decora.

Passiflora ambigua.

Calyptrogyne sarapiguensis.—(S. America).

Marcgraavia umbellata developed several bunches of buds, which however never opened.

Dendrocalamus pendulus.—Both the big clumps of this splendid Bamboo began to flower and die at the end of the year.

Cola acuminata.—Fruited heavily in the Economic Gardens for the first time, a batch of seedlings was raised.

Dichopsis oblongifolia.—Fruited heavily in the Economic Gardens and also in the Garden jungle.

Camoensia maxima, produced fruit for the first time. A species of *Canthium* received some years ago from Uganda, under the name of *Matagonda* "Edible fruit" fruited this year. It is a shrub with small green flowers, and little round yellow fruit. It does not appear to be a very valuable addition to our stock of dessert fruit.

Plants and Seeds Received.

During the year there were 7,535 plants and 358 packets of seeds received, the donors being Messrs. E. L. HOLMES, Professor SARGENT, Dr. SCHLECHTER, A. D. MACHADO, J. D'A. PEREIRA, L. BOEHMER & Co., H. DREER, F. GLAZEBROOK, H. ENG WATT, C. CURTIS, CARTER & Co., DAMMAN & Co., T. D. TAITE, Hon'ble W. J. NAPIER, H. CANNELL & SONS, C. B. KLOSS, ST. V. B. DOWN, J. C. HARVEY, M. HERB, JAMES VEITCH & SONS, Mr. T. W. BROWN, Mr. VALENTINE KNIGHT, Mr. BEAUCLERK, Mr. LYON, Mr. WEBERBOUR, and the Botanic Gardens of Kew, Grenada, Taiping, Manila, Buitenzorg, Washington, Rangoon, Ceylon, Calcutta, Sydney, British Guiana, Trinidad, Seychelles, Honolulu, Berlin, Durban, Congo, Hongkong, Cairo, Nogent sur Marne and the Arnold Arboretum.

Plants and Seeds sent out.

Excluding Para Rubber seeds and plants, 2,491 plants and 236 packets of seeds (ornamental and foliage) were sent out. The recipients were Messrs. C. CURTIS, H. ENG WATT, ST. V. B. DOWN, Dr. SEFFER, Dr. SCHLECHTER, H. DREER, A. D. MACHADO, MISS GAGE BROWN, Mr. MARINER, BOEHMER & Co., V. KNIGHT, S. BIDI & Co., A. M. BURN-MURDOCH, Mr. BEAUCLERK, M. LYON and the Botanic Gardens of Rangoon, Buitenzorg, Penang, Lagos, Natal, Brisbane, Ceylon, Trinidad, Hongkong, Kew, Jamaica, Calcutta, Madras, Trivandrum, Queensland, Honolulu and Sydney. Plants were also supplied to Government House Domain, General Hospital, Hospital Grounds at Labuan, Chief Police Officer's quarters, Municipal Roads and Reservoir and Military Gardens at Tanglin and Blakan Mati. This does not of course include the plants and seeds sold.

Herbarium.

Except a short trip during the Easter Holidays to Johore made by the Director, it was impossible to make any botanical expeditions. A collection of 234 specimens from Southern India was made by the Clerk Mr. J. S. ISAAC when on leave, and presented to the Herbarium; 100 specimens of Philippine plants were received from Mr. COPELAND of Manila, 25 specimens from Bintang Island from Mr. C. B. KLOSS and 84 specimens from the Botanic Gardens of Buitenzorg.

Three packets of specimens were sent to the British Museum, two to Dr. BECCARI, three packets to Prince ROLAND BUONAPARTE and 93 fungi in alcohol, with drawings made by the Artist, to Kew. The account of these fungi, the first

collection of Agaricini sent from the Peninsula, are described in the "Kew Bulletin" and contain a considerable number of new species.

The whole Herbarium was re-poisoned, a work which occupied four men for four months, and used 50 gallons of Methylated Spirits and Corrosive Sublimate. This was considered necessary as on one morning it was found that the termites had during the night invaded the building and had carried tunnels almost into the cabinets. As there are a large number of types and cotypes of different species of plants in the collection the loss of which would be irreparable, the assistance of the Public Works Department was called in to minimize the risk of the destruction of the building and its more valuable contents, by painting the vulnerable parts of the building with Jodelite.

Publications.

Three volumes on the Monocotyledons of the Malay Peninsula by the Director were published during the year, forming part of the series of the "Materials for a Flora of the Malay Peninsula" which are being published under the direction of Sir GEORGE KING.

The "Agricultural Bulletin" was published monthly as usual.

Library.

During the year 76 monthly, five weekly and three quarterly publications of other establishments, 158 books, annual reports and pamphlets were received. Nearly all these are obtained in exchange for the "Bulletin" and Gardens Reports.

The Agricultural Show.

This Show was held in Kuala Kangsar this year, and the Superintendent Mr. W. Fox represented the Settlement at it. Comparatively few exhibits were sent from Singapore.

REVENUE AND EXPENDITURE FOR THE YEAR 1907.

"Up-Keep of Botanic Gardens."

REVENUE.

		\$	c.	\$	c.
By balance in Bank on 1st January, 1907	...	1,875	74	...	...
Government Grant for the year 1907	...	8,000	00	...	...
By sale of Economic Plants and Seeds	...	6,312	63	...	...
By sale of Ornamental Plants and Seeds	...	1,030	27	17,218	64
(A sum of \$1,420.55 for the sale of Economic Plants and Seeds, supplied during the year not collected up to 31st December).					

EXPENDITURE.

		\$	c.	\$	c.
Wages	...	6,656	29	...	...
Bills	...	8,022	94	14,679	23
Balance in Bank on 31st December	...			2,539	41

Inspection of Coconut Trees.

Notices were served on 174 persons but no prosecutions were necessary. Three hundred and forty-five trees and forty stumps were destroyed and fifty piles of rubbish likely to contain beetles. The beetles can perhaps hardly be stated to be quite extinct in the Island, but they have become pretty scarce nowadays and the destruction of trees by them now is quite insignificant. Care will have to be taken in the future to prevent their return.

		\$	c.
Amount allowed in the Estimate to carry out this Ordinance	...	210	00
Amount Expended on transport	...	204	08
Balance	...	5	92

ECONOMIC GARDENS.

A small store was erected in the Economic Gardens in place of the old wooden shed which was in use for so many years.

The Municipality in making a new road in the neighbourhood asked to be allowed to take soil from the hill opposite in the arboretum to fill up a swamp. This was permitted on condition of the hill being levelled and turfed. The excavations necessary were very unsightly for some time but by the end of the year they were filled in and levelled, and will shortly be turfed.

The Garden was kept up in a very good condition as well as could be expected, considering for the greater part of the year, the European staff was reduced to the Assistant only. The export of plants and seeds of economic interest was greater than usual, not only in Para Rubber, but in other products, a matter of satisfaction as it shows that the agriculture of the tropical English colonies is not being confined to Rubber only.

There was a demand for seeds of the Oil Palm (*Elaeisguineensis*) due to an article in the "Agricultural Bulletin" of this year pointing out the value of this plant in cultivation. Fibre plants were also in great request and though the cultivation of these has been slowly making its way in the Peninsula, still there are signs of its really playing an important part in the local cultivation in the near future.

Catch crops for rubber as represented by Ground-nut, Citronella and Lemon-grass, were in demand. Camphor seedlings were taken for trial in several of the Estates in the Federated Malay States. Fruit trees were required also largely for the Federated Malay States, where the supply of fruit is by no means what could be desired.

The Para Rubber seed crop was the biggest on record, viz., 410,600 of which 405,600 seeds and 13,100 seedlings were disposed of. The Gutta Percha fruited well and 1,380 seeds were sent to Mauritius, but travelled very badly. Of *Willughbeia firma*, 18 seedlings were sold. Besides these 100,000 Rubber seeds were purchased, packed and sent to British New Guinea.

Fibre plants were sold as follows:—Ramie 3,170, Sansevieria 10,000, Manila Hemp 130, Mauritius Hemp 150 and of Fruit trees various kinds 1,700 plants and 12,000 seeds.

A big sending of Coconuts to Lagos was 3,000 nuts in crates, and requiring 30 carts to convey them to the docks.

Of Tapioca 300 plants, Coffee 125, Citronella 160, Lemon-grass 250, Camphor 750, Cocoa 160, Nutmeg 172, Oil Palm 3,030 seeds, Ground-nuts 50 lbs. seeds.

The greater part of these seeds and plants were supplied to the Federated Malay States and Johore, chiefly to Selangor and Perak. Of other Colonies, Lagos, British New Guinea, Southern Nigeria, and the Caroline Islands were the chief recipients.

The total export of plants and seeds this year was:—

Economic Plants	...	...	...	...	18,085
Ornamental Plants	...	...	...	...	6,744 = 24,829
Economic Plant Seeds	...	...	...	...	525,310

Ornamental Plant Seeds (sold and exchanged) 558 Packets.

This export entailed a very large amount of labour and correspondence. An extra seed boy to collect seed was employed, and a larger number of men than usual were required to gather the large crop of rubber seeds. When the Gutta Percha trees were fruiting, the fruit bats attacked the fruit in such numbers that it was with difficulty that any of the crop was saved at all. The lower part of the best tree was covered with cloth and nets, lights were put in the tree and a Tamil Batcatcher employed.

Experimental Rubber Tapping.

During the absence of the Director, Mr. FOX the Superintendent from Penang Gardens carried on the researches as to growth and returns of the Rubber trees, though for the whole nine months he was required to do the whole work of the two Gardens single handed. The records were carefully kept, and the report will be shortly completed. The rubber prepared during the experiments was sold locally and fetched \$3,194.32. Part of the money obtained by the sale of the rubber was utilized in installing a water supply to the Botanic Gardens, which has long been needed, and which was otherwise unprocurable. This installation cost five thousand dollars.

Summary.

Considering that the Staff was this year reduced by the Director's absence for over eight months to Mr. FOX assisted by the Clerk Mr. J. S. ISAAC the amount of work executed was very great. The Gardens were kept in good order and many improvements made, the export of seeds and plants and correspondence exceptionally large, and a considerable amount of experimental research carried on, and the "Agricultural Bulletin" published monthly, all this work could not have been effected but by great energy and industry on the part of the Assistant and of the Clerk.

H. N. RIDLEY,

Director of Gardens, Straits Settlements.

Annual Report on the Botanic Gardens, Penang, 1907.

Staff.

1. The Gardens were in charge of the Collector of Land Revenue with the assistance of MOHAMED HANIFF, Garden Overseer, up to March 26th, when Mr. FOX (Superintendent) returned from leave. Mr. FOX only remained up to April 23rd, when he proceeded to Singapore to act for the Director of Gardens, and was replaced on the following day by the writer, Assistant Superintendent, Botanic Gardens, Singapore, who remained in charge of the Gardens for the remainder of the year.

MOHAMED HANIFF was on leave for three months from the 17th June, this being his first leave after 18 years' service.

The check roll shows much broken time, due to Fever and acute Diarrhœa, but equally or possibly more to slight feverish symptoms which disincline a cooly to turn out without the incentive of mustering on the spot, and this is unavoidable as the lines have been placed one mile distant from the Gardens with the object of obtaining good sanitation.

The Year's Work.

2. Despite these changes a large programme of work has been carried out, an important item of which was the increased maintenance and renewal of stock consequent on large sales of palms and general decorative plants. This will be better understood if I say that the revenue collected by sales amounted to \$1,111.24, which constitutes a record in the revenue return of these gardens. The highest returns previously recorded were \$974 in 1897, and \$1,014 in 1894.

3. Inadequate accommodation has always been the drawback to the maintenance and renewal of stock but on the representation of Mr. FOX an acre of land has been purchased at the Garden entrance and this difficulty will disappear. It will now be possible to maintain small lots of fruit trees and other useful economic plants. In this direction the most notable additions include *Palauquium oblongifolium*, or getah taban, raised from seeds obtained within the Garden, and although only three trees fruited the crop was exceptionally heavy; and although 3,670 seeds sold to the Conservator of Forests, and 500 seeds to the Government of Mauritius, a batch of 1,550 seedlings was reserved for the Gardens: *Hevea brasiliensis* practically failed as a seed-crop, 4,700 seeds were sold and 250 seedlings raised. Other additions include 200 nutmegs, 300 durians, and a few mangosteens. Of other economics of which specimens only were received the following may be cited:—West Indian Bread-nut (*Artocarpus nucifera*), Australian fodder grass (*Paspalum dilatatum*), ten species of Bow string Hemp, *Sansevieria* (species), Bornean Lemon (*Citrus* sp), *Eugenia uniflora*, *Eugenia brasiliensis*, *Anona reticulata*, *Psidium guava* (Trinidad), and some good varieties of bananas and pineapples.

Free Issues.

4. Trees and shrubs were supplied free to the Supreme Court grounds, District Hospital, Government Quarters, and Residency; the latter also received a miscellaneous selection of pot plants. A small lot of seeds was given to the Pulau Tikus College.

Exchanges.

5. Plants were supplied free to:—

Botanic Gardens, Rangoon	...	2 cases miscellaneous Ferns
Botanic Gardens, Singapore	...	1 plant <i>Amorphophallus Titanum</i>
German Consul, Padang	...	1 case of Palms
Mr. Tong Takin, Kwala Lumpur	...	6 Adiantums
Mr. Beauclerk do.	...	1 box of Cannas

Received in exchange from:—

Plantations Department, Perak	...	20 packets of Seeds
Do., do.	...	48 Ferns and Bulbs
Botanic Gardens, Jamaica	...	1 packet of seeds <i>Cyphomandra betacea</i>
Do., Ceylon	...	1 do. do.
Do., Calcutta	...	4 do. Palms
Do., Trinidad	...	1 do.
Do., Singapore	...	4 do. and 341 plants
Do., Rangoon	...	4 do.
Agricultural Department, Honolulu	...	54 do.
Commissioner, Honolulu	...	40 packets of Seeds
Messrs. Damman, Naples	...	23 do.
Messrs. Herb, do.	...	26 do.
Messrs. Cooper, Nurseries, Victoria	...	34 do.
E. C. Ollenbach Esq.	...	6 <i>Phalænopsis</i>
C. Curtis Esq.	...	1 packet of seeds and 25 Bulbs
Dr. Wright, Perak	...	20 Bulbs, <i>Caladiums</i>
W. Allen Esq., Rangoon	...	11 Orchids
W. Beauclerk Esq., Java	...	46 Orchids
Mr. Mohammed Haniff (Overseer)	...	Ferns, Orchids and Aroids, several cases
Mr. Tong Takin	...	29 <i>Caladiums</i> tubers
D. Logan Esq.	...	25 seeds, <i>Spondias lutea</i>
J. Irving Esq.	...	1 packet of seeds
The Residency	...	7 plants
Mr. Cerutti	...	1 lot Rose-cuttings

From the Royal Botanic Gardens, Kew, a wardian case of 50 plants of (*Manicoba*) Ceara Rubber, said to be a superior variety, was received and these have been planted at Tasek Glugor Forest Reserve in Province Wellesley.

6. Some new ferns and palms were added to the Garden collections from the Botanic Gardens, Singapore, and several flowering or decorative plants. The collection of *Caladiums* was enriched by some new choice varieties. From the German Consul at Padang the gigantic terrestrial aroid (*Amorphophallus Titanum*) has been received. The collection of Cannas is large and includes many novelties and made a fine display during the latter months of the year.

7. A sum of \$129.24 has been expended in the purchase of plants and seeds. This is a very small amount compared with the receipts and it should be mentioned that it is not as easy now as formerly to obtain new plants, particularly novelties, by exchange, owing to the preference for temperate rather than tropical plants in home gardens. To obtain new varieties a small sum must be expended for which an assured return may be expected. New plants if novelties are much in demand.

Routine.

8. During the absence of the Superintendent for one year, the garden was kept in good order and the general appearance maintained. There remained, however, some urgent arrears which have now been carried out. All the South American *Cattleyas*, the beautiful Orchids so much admired, were losing their vigour and these have been

re-potted and are making new growths. In the other plant houses all the pot-plants have been re-potted, rearranged, and represent care and culture.

Improvements.

9. The Penang Garden is now 25 years old and when first commenced it contained many interesting indigenous specimens of trees and palms which have been preserved, while the groups and specimens since planted have made so much growth that the time has arrived for some landscape effects. Some years ago the waterfall was the most striking natural feature of the garden, but latterly it was not easy to view from any part of the garden, and escaped the notice of most visitors. The best view of it which is from the Band-stand has been improved by the removal and pruning of superfluous foliage. The waterfall itself is considerably overgrown and if permission can be obtained it should be recleared during the next dry weather.

The most important landscape effect has, however, been obtained by opening a vista from a point on the main drive near the entrance to the garden looking across the stream towards the plant nurseries. The two cascades over the stream are brought prominently into view and a long border of brilliant coloured Cannas between the cascades of water furnishes a pleasing picture. Some other flower-beds have been added and the general appearance of this part of the garden has been made brighter. The work involved the removal of a huge clump of the common and rather formidable bamboo (*Bambusa spinosa*). This species grows into an almost impenetrable mass which is difficult to destroy (unless by fire which cannot be used in a public garden) so that the task of removing it proved an arduous one.

The main drive already referred to has been slightly improved by reducing an ugly bend.

10. By far the largest undertaking however has been the commencement of converting the ravine running from the circular road to the swimming bath into a natural rockery for the reception of the large collection of Aroids and certain shade-loving Palms.

It will perhaps be well to explain here that this so-called bath is really the Garden reservoir, which supplies the plant sheds and nurseries with water through one-inch iron pipes, and that since the club swimming bath started at Tanjong Bungah the Garden bath has fallen into almost entire disuse. The reservoir is essentially necessary and must be maintained, but the Garden funds would not stand the cost of renewing the dilapidated buildings (dressing-rooms, etc.,) which were so very occasionally used and the opportunity was therefore taken to utilize the ravine for the purpose stated. When completed (considering the richness of Aroids in the Malayan flora) a most interesting and valuable collection of these plants will be permanently established for study or enjoyment in a cool retreat. Several species of epiphytic Aroids already abound on trees growing in the ravine; others have been planted. In building the rockery, the bed of the stream has been contoured so as to form a feature of the work. Of the Aroids planted which include duplicates of all our Anthuriums, Alocasias, Amorphophallus, Spathiphyllum, Dieffenbachia, Schismatoglottis, Homalomena, Aglaonema, Philodendron, Pothos, Schizocasia and Caladiums all have grown well.

At the time of writing the plants of *Spathiphyllum cannaefolium* furnish a nice display of white flower-spathes which are deliciously fragrant in the mornings and evenings. A little time must elapse before the Anthuriums represent their best; but those specimens which have flowered exhibit more perfect and better coloured spathes under the natural shade than is ever obtained with pot-plants under artificial shade.

Aquatic Aroids and the 'Keladi' or Colocasias and Xanthosomas are not yet provided for.

Upkeep and Buildings.

11. The dam across the reservoir was found to be leaky. The faces have been re-cemented and a new hardwood water gate provided. The reservoir has also been thoroughly cleaned and the accumulated wash-sand removed.

The bertam chicks on the iron or No. 1 plant house have been entirely renewed. Many of the posts and beams of No. 3 plant house have been renewed and painted, and the whole roof renewed with split nibongs.

The circular drive from the Aroid ravine as far as the Band-stand or a distance of 200 yards has been re-metalled with 3 inches of granite by the Public Works Department. The same department has also renewed the two rustic bridges crossing the stream near the fern rockery.

Library and Herbarium.

12. For the former the usual periodicals have been purchased or received from other Botanical and Agricultural Establishments. Mr. WRIGHT'S Cantor lecture on Para Rubber was purchased, and Volume IX, Part II of the Annals of Calcutta Botanic Garden, containing descriptions and drawings of the Orchids of North-West Himalaya presented. Various volumes of periodicals and journals have been bound.

The Herbarium building although repaired is still very unsatisfactory. During the latter part of the year the excessive damp and consequent mould on the specimens has been very troublesome, but with the aid of charcoal fires in chatties the Herbarium has been kept as dry as possible. Something however must be done, or the life of the Herbarium will not be a long one, and considering the cramped space for Office and Library, and the urgent need of a room suitable for a store for tools, seeds, bulbs, rubber, and other specimens, this need would be met by converting the Herbarium into a store and erecting a new one on arches instead of a ground-floor on sloping ground. A space of 30 by 20 feet would suffice for a herbarium.

Owing to arrears and pressure of work, I was not able to suggest any collecting trips, but the garden Overseer paid a visit to the Singapore Gardens and obtained eleven cases of miscellaneous plants, all desirable additions to this garden.

Rubber Notes.

13. Including the trees at the old experimental nursery on the hill there are 43 Para trees in the garden; of these seventeen are over three feet in girth, nineteen over and seven under two feet. I had expected there were more. In the absence of MOHAMED HANIFF it was necessary to train a man to tap and 21 trees were tapped and 35 lbs. of Rubber obtained. Now that a man can tap without injury, this work will proceed better although the drying process is difficult and long, through smoking being necessary owing to the damp situation of the garden. The old Para tree supplied two pounds of dry Rubber making the grand total from this tree 37 lbs. 13½ ozs. All the Rubber is not yet dry enough for sale.

Governor's Hill Bungalow Garden.

14. The labour band has been very unsatisfactory, but thanks to the energy of the Overseer in charge (Mr. FERNANDO), the grounds have been maintained in good order.

The Rainfall amounted to inches 124.17 of which amount 57.41 inches fell in the three months of September, October, November, or an average of 19 inches. As might be expected in such inclement weather the vegetable supply fails but improves with the dry season, when unfortunately the want of a water supply is a serious drawback.

A few introductions such as Lima and Runner beans are promising and a few seedlings of the Tree Tomato (*Cyphomandra betacea*) have been raised.

Vegetables are no longer supplied free, and since last September a sum of \$15.37 has been collected for supplies to Government Bungalow. This amount is included in the Waterfall Garden Return. A sum of \$51.89 was expended in the purchase of new roses, which arrived in perfect condition and will be planted when established. Flower and vegetable seeds cost \$25.22.

Coconut Trees Preservation.

15. The number of notices issued in connection with infected trees and manure not properly stored amounted to 755.

Fortunately for this Settlement beetles are the only pest and the dreaded Bud-Rot has not appeared; but the area to be inspected is far too large for one Inspector, and a Sub-Inspector is allowed for next year.

There were nine prosecutions in Penang and four in Province Wellesley. The fines inflicted amounting to \$15.50 only. I strongly think this leniency will result in more unnecessary work for the Inspectors and the real work of inspection will fall into arrears. It may not seem a serious breach of the Ordinance for a small foot bridge or fence of coconut stems to be used and in solitary instances there would not be any danger of maintaining breeding grounds for the beetles, but if every one so utilized their fallen stems (and this is done in Province Wellesley far too much) an additional danger in this direction would exist, as the attention of the Inspectors would be divided between unburied stems and standing trees.

General.

16. I attended the Agri-Horticultural Show held at Kwala Kangsar in August and took charge of the Penang exhibits. There were 122 exhibitors and 700 entries

in 168 classes. The Settlement was very successful and carried off 48 first prizes, 24 second prizes, 7 third prizes, and 3 exhibits were highly commended.

Excepting horticulture (plants and flowers) all the large divisions were well represented, and while there is a general consensus of opinion as to the educational and other advantages of such shows, there does not appear to be any probability of a higher or other standard forthcoming. To effect a change in the present practice of agriculture I suggest that the best prospect of improvement lies in the encouragement and assistance of school gardens as is done in the West Indies and Ceylon. Without such early teaching the market gardener will fail to realize that quality may be made or modified by selection and varied cultivation, and the small coconut planter will proceed on the same lines as hitherto, waiting years for a crop instead of being profitably engaged in cultivating as catch crops, citronella or lemon-grass oils, improving his property and at the same time assisting to build up a large oil industry. A larger demand for vegetable oils seems probable and the countries best equipped will be naturally the first to reap the benefit. An Agricultural Show would determine whether the oil was purer or a vegetable more succulent; to the observant it would most likely indicate the direction in which improvement might be expected, but first of all the methods of agriculture as now practised must be altered, and I cannot conceive how such alteration can be effected except in the way suggested.

17. Appendices * are attached showing Revenue and Expenditure of the Waterfall Gardens, Governor's Hill Bungalow grounds, Transport and Personal Allowances Coconut Trees Preservation; and * returns of the work done under the Coconut Tree, Preservation, and the Rainfall recorded at the Hill, Fort, and Prison.

R. DERRY.

Acting Superintendent of Forests and Gardens.

22nd January, 1908.

Return of Rainfall for the Criminal Prison, Fort Cornwallis, and Government Hill during the year, 1907.—(Contributed.)

MONTHS.				Prison.	Fort.	Government Hill.
January	...	...	...	1'54	1'79	3'89
February	...	...	...	80	1'12	1'18
March	...	...	...	6'34	6'50	7'69
April	...	...	...	1'43	1'10	2'34
May	...	...	...	5'94	5'96	10'51
June	...	...	...	4'18	5'81	11'97
July	...	...	...	8'10	5'80	14'73
August	...	...	...	4'68	3'82	5'88
September	...	...	...	8'07	10'23	15'96
October	...	...	...	12'63	6'45	19'71
November	...	...	...	17'16	11'95	21'74
December	...	...	...	7'42	6'50	8'57
Total				78'29	67'03	124'17

* Not printed.

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS

SINGAPORE AND PENANG,

FOR THE YEAR

1908

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.



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1909.

Annual Report on the Botanic Gardens, Singapore, for the Year 1908.

Staff.

The Director returned from leave on the 24th January, and Mr. DERRY, the Curator, left on the same day for long leave, Mr. T. W. MAIN was appointed as Assistant Curator on 1st April. The Department now has for the first time in its existence two European Assistants in Singapore. This addition to the staff has been urgently required for many years, as the amount of work demanded of the Department has increased to such an extent that a single Assistant could not cope with it; Mr. MAIN takes charge of the Upper Garden, and Mr. DERRY the Economic Garden.

The coolies worked fairly well, but as the price of labour keeps up so high in Singapore and the Malay States still, the Gardens Department loses many of the best men who leave for higher pay outside.

In the early part of the year there was a good deal of Malaria in the Lines, as there was in other parts of Singapore at the time, and on the return of the Director steps were taken at once to remedy this; the secondary scrub round the Lines which was swarming with mosquitos was cut down and destroyed, and all tins, broken pots and other breeding grounds removed, the mud drains from the Lines bricked, and the place generally cleaned up, when the fever immediately disappeared there being no more cases.

Before this work was executed, however, one coolie who was attacked died in three days. This is only the fifth death in the Gardens Coolie Lines within the past twenty years. The other cases being two from Beri-beri some years ago during the absence of the Director on leave, one case of rapid acute Diarrhœa, (probably ptomaine poisoning), and one baby girl. When it is considered that of the large number employed during this period many are men who have left other employment in the Native States on account of ill health, this speaks a good deal for the healthiness of the Coolie Lines.

Visitors.

The number of foreign Botanists and Agriculturists who visits the Gardens still increases, and among the better-known visitors this year were:—Prof. CZAPEK, Mr. E. D. MERRILL (Philippines), Dr. H. WINKLER (Breslau), Dr. F. W. FOXWORTHY (Manila), Dr. M. SIEDLECKI (Cracow), Prof. N. J. TISCHLER (Heidelberg), Governor E. Y. MILLER (Palawan), Mr. G. C. DRUCE (Oxford), Dr. H. P. STEVENS, Mr. HERBERT WRIGHT and C. KELWAY BAMBER, Mr. DUBEDAT and M. JOURDAN of Phuquoc, E. J. KAPPLER (Manila), C. E. HERBERT (Port Darwin), Mr. WATERHOUSE (Honolulu), Mr. A. H. BENSON Agricultural Department, Brisbane, Mr. C. S. BANKES (Manila); besides the usual large number of planters from the Malay States, Borneo, Sumatra, Riouw and other neighbouring countries.

Garden Rules.

The Garden Rules were revised with the approval of His Excellency the Governor and gazetted. Few alterations were necessary, but a regulation as to Motor Cars was added.

Buildings.

During the year the Clerk's and Foreman-Gardener's quarters in the Economic Gardens were entirely rebuilt by the Public Works Department, a new glass house was built in the Upper Gardens at a cost of \$970. It measures 52 feet long, 12 feet broad and 11 feet 6 inches high and on the outer side a row of frames was built 52' X 5' X 2½'. This house is most useful for delicate plants, succulents, orchids and the

like. A new office of brick and plaster was built in the Economic Gardens, for the Assistant in charge of this part of the Gardens. It measures 20' X 14' X 12' and cost \$800. Two latrines for visitors were built of brick in the shrubbery where the animal cages formerly were, size of building 12' X 8' X 6'. In the Coolie Lines the drains were bricked for a length of 780 feet, viz., 346' X 12" X 10", 82' X 14" X 14", 250' X 8" X 12"; several silt tanks were built and the wells were repaired, the buildings of the Coolie Lines and Policemen's quarters were partially reattaped, and others were repaired and an extra room was built on to the Artist's quarters. The well in the nursery was redug, bricked and cemented.

The wooden floor of the Gardens Office was removed and the ground filled in and covered with cement and concrete by the Public Works Department. This had proved necessary on account of the persistent attacks of termites which invaded the office during the night and nearly destroyed the books and papers in the office.

Roads and Drives, Beds, Etc.

All the roads in the Upper Gardens were re-gravelled and repaired where necessary. The lower circle path round the band-stand was relaid with laterite. Two new rollers were purchased for this work.

The lake was cleaned of waterweeds on several occasions and some hundreds of loads of silt and mud were taken out of the upper end in April and banked up on the side being kept in place by piles, and a large cement tank 4' X 4'—6" X 4' was built to receive the silt brought down in rain storms from Garden Road and Tyersall Road. As this silt is brought down from the mainroads into the Garden the Municipality was asked to take steps to turn the road drains from the Gardens, but nothing effective was done.

Side drains, the bricking and repairing of the side drains all over the Gardens was pushed on and a large number of the remaining earth drains were bricked. In all, 917 yards of brick drain were laid down in the Upper Gardens. Catch tanks were also built where necessary.

New or Noteworthy Plants.

The following plants of interest flowered for the first time in the Gardens:—

Dendrobium Lankawiense.—Lankawi.

Do. *pachyglossum*.—Perak.

Bulbophyllum variabile.—Perak.

Coelogyne carnea.—Perak.

Wallichia disticha.—India.

Dædalacanthus parvus.—India.

Begonia pauperula.—Selangor.

Burbridgea schizocheila.—Borneo. (Flowered and fruited. The fruits of this genus were not previously known.)

Baryxylum rufum.—Saigon.

Dendrocolla N., *sp.*.—Manila.

Wormia meliosmæfolia.—Malacca.

Geodorum pulchellum N. sp..—Siam.

Dendrobium sp..—Philippines.

Sterculia alata.—India.

Ceropegia Woodii.—Natal.

Cyperus papyrus.—Africa.

Gloriosa rothschildiana.—Africa.

Urginia micrantha.—Africa.

Kicksia africana.—Africa. Flowered and fruited.

Cotyledon pachyphyllum.

Caryocar nuciferum.

Hibiscus Californicus.—North America.

Dichorisandra aubletiana var *persicariaefolium*.—South America.

Euterpe stenophylla.—South America.

Cuphea petiolata.

Amorphophallus titanum received from Padang^a flowered and the great flower spike and enormous leaf which followed it were very attractive to visitors. A *Salvia* received under the name of *Zurich* proved very successful as a bedding plant and a useful addition to the beds. There was a good show of *Antirrhinums*, a plant not very well suited to our climate, *Mussaenda erythrophylla* of the Congo was remarkably beautiful and plants sent to Kew attracted the notice of visitors there, causing a demand in Europe for the plant which had long been lost out of cultivation in Europe.

Plant Houses.

All the plants in these houses were repotted and renewed, many old plants taken out and replanted in the Gardens, and replaced by younger plants. The flower house was with some difficulty kept bright with flowers throughout the year. The herbaceous plants last so short a time in full flower in this climate, that to keep a house of this size well stocked requires a very large amount of stock plants to be kept growing. The houses were highly appreciated by the visitors, the fine exhibition of *Adiantums*, the big *Amorphophallus titanum* and *Platyceriums* and *Thamnopteris* especially attracting remark.

Beds and Borders.

Several of the ornamental borders were replanted and heavily manured and the one by the Garden Office continued for a length of 75 feet. The other parallel to Garden Road was entirely taken up, trenched and manured and replanted. The *Canna* beds were trenched to a depth of two-and-a-half feet and heavily manured and replanted the result being a superb show of *Cannas* of great size and brilliancy. Several others of the smaller beds were redug, manured and replanted and in many cases new soil was brought and the worn-out soil changed. Several new beds were built. By the lake, vistas were cut through the *Wormia* bushes and ornamental beds of purple grass and other bright plants were made on the further side. New *Victoria regias* and other water lilies were planted and all well manured. No less than 500 loads of manure were used in this part of the Garden this year.

Expeditions.

The Director made several short expeditions during the year to various places in search of plants. In the early part of the year a few days were spent at Cucob in Johore, where a number of rare and new plants were obtained including one new genus of *Scitamineæ*, later a visit was made to Tebrau, and by the assistance of Mr. BRYCE who resided there a day was spent at Sednak along the railway. Many plants were obtained here. The Agricultural Exhibition was held at Kuala Lumpur this year and during the week of the show the plant collector who accompanied the Director made useful collections in the neighbourhood. After the show was over visits were made to the Batu Caves and Klang Gates, a remarkable mass of sandstone with a very distinct xerophytic flora. A number of new plants were obtained here, though the season had been so dry that many plants were out of flower. In November, an expedition was made to the main chain of the Peninsula at Telom by the Director, Mr. H. C. ROBINSON, and Mr. C. B. KLOSS. The Director went to Tapah first to await the arrival of the other members of the party, and as there was some delay, spent the time in collecting in the neighbourhood of Tapah, where a number of interesting plants including some new ones were found, the most noticeable being a fine new *Phrynium* with highly ornamental foliage, of which on the return living plants were brought to the Gardens. On the arrival of the party a start was made from Telom through the Batang Padang valley. It was reached in three days and during the stay of nearly three weeks, the Director and plant collector made extensive collections. A very large number of novelties were obtained, the most interesting being a new genus of *Liliaceæ* allied to *Tupistra* and a number of plants of the Himalayo-Javanese flora previously unknown in the Peninsula including *Sanicula*, *Sarcopyramis* and *Disporum*. An account of this flora is being prepared for publication.

In all these expeditions living plants of interest and beauty were brought successfully to the Botanic Gardens.

Herbarium.

Besides the large series of plants obtained by the Director on his expeditions there were received the following additions to the Herbarium:—

Borneo plants—a large series from Sarawak containing many novelties from Mr. J. HEWITT, Mr. C. J. BROOKES, and Mr. LEWIS.

A set of FORBES' plants (895) from Java, Sumatra, and Borneo, received in exchange from the British Museum.

One hundred and ten Indian plants from Mr. R. D. HUDSON.

Three hundred and seventy-two Plants of Texas collected by LINDHEIMER presented by the Missouri Gardens.

Specimens were also received from Mr. BURN-MURDOCH from Selangor, Mr. FOXWORTHY (Borneo), Mr. MICHOLITZ, Mr. MERRILL and Mr. ELMER from Manila.

The collection of *Laurineæ* was loaned to Mr. GAMBLE for the flora of the Peninsula. Five hundred and seventy-six plants were sent in exchange to the British Museum, 1,600 to Kew, 256 to Berlin Botanic Gardens and 195 to the Manila Botanic Department.

Three pairs of new cabinets were made for the Herbarium.

Publications.

An index to the three volumes of Monocotyledons of the Malay Peninsula published the previous year was printed. A full account of the *Scitamineæ* of the Philippines was completed. A paper on a number of new and rare Malayan plants were published by the Director in the "Journal of the Royal Asiatic Society," Straits Branch, and also a list of the ferns of the Malay Peninsula and an account of the Labiates of the Malay Peninsula.

The "Agricultural Bulletin" appeared monthly as usual and was in much request. It was found necessary, however, to make some changes in the method of publication. Formerly it was to a large extent printed by the Government Printing Office. But this occasioned great delay in the appearance of the numbers and as the planters were anxious to have the reports of the Association meetings brought out punctually on the first of the month, it was necessary to transfer the whole of the publication to the American Mission Press. The cost of having the "Bulletin" thus published by an outside Press was, however, considerably in excess of the revenue obtained for the "Bulletin" by subscriptions and sales. To meet this it was necessary to procure advertisements and to increase the cost of the "Bulletin" from \$3 a year to \$5 for subscribers.

The number of subscribers to the "Bulletin" is steadily increasing.

The Artist resigned his position at the end of the year. The Botany lectures to the Medical Students were delivered by the Director twice a week from August to the end of October.

Water Installation.

The installation of a water supply to the Gardens was completed early in the year. This work was commenced late in 1907, but it was not until this year that the installation was completed.

The scheme has proved an entire success far beyond expectations and has proved a great saving of both money and labour.

The engine worked constantly during the year and gave no trouble. The water is pumped up by means of a two-horse-power oil engine from the lake well into a 5,000-gallon iron tank at top of the Gardens and radiates from there by means of pipes to different parts of the Gardens and Plant Houses. In all six standpipes are at present in use.

Economic Gardens.

In the Economic Gardens a new Office was built and furnished as mentioned in a previous paragraph, and the quarters of the Clerk and the Foreman-Gardeners were entirely rebuilt by the Public Works Department.

About $3\frac{1}{2}$ acres of scrub were cleared and dug at the end of the Garden, 20 extra coolies and a Mandore were employed on this work for two months. A part of the wood on the top of the hill was thinned out and cleared of climbers and ferns, and Nutmegs and Cloves were planted through it in lines. It seems clear thus Nutmegs do better in partial shade than in full sun. The scrub on the hill sloping to Cluny Road, was thinned out for planting Camphor trees, and the Gutta Percha trees on this ground were cleared round, and are making a good growth. Crotalaria seed was sown

in several of the new cleared portions of the ground but came up badly. Dal (*Cajanus indicus*) was planted on the top of the hill where Coffee used to be cultivated with a view of improving the soil. Though this plant grows well and becomes large, it fruits very poorly, otherwise it would be a valuable addition to our annual crops.

There were a number of trees added to the Arboretum and a fair stock of fruit trees, and other trees of economic value kept up.

Seeds of the Manicoba Rubber, *Manihot piauhyensis* and *M. dichotoma* were received from Kew, germinated well and were planted out.

The Rubber Experiments were continued during the year, and some Experiments were made with Chemical Manures.

Plants and Seeds Exported.

The demand for Para Rubber seed still continued, for the African and West Indian Colonies chiefly, 330,345 seeds were exported. The recipients reported very well of the germination of the seeds after long voyages. Ten thousand three hundred plants of Para Rubber were also disposed of mostly in the Island of Singapore. Seeds of the Manicoba rubber were also sent to Penang, Taiping, Christmas Island and Johore.

A considerable number of plants of economic use were supplied to Christmas Island, and the Lighthouses were supplied with fruit trees and vegetable seed.

Ramie was in demand again owing to the formation of the Malayan Ramie Company, which is establishing its plantations in Borneo. Three thousand plants were supplied, and the results are reported as extremely good. Three varieties were sent, the one known as Singapore strain giving the best results. Five hundred and thirty other fibre plants were supplied to other cultivators. Spices were in small demand. Six hundred and three plants of Nutmegs, Cloves, Vanilla and *Cinnamomum* were sent out. Shade trees, four hundred with twelve pounds of *Albizia*, and about a thousand fruit trees, were disposed of, and 150 Gutta Percha plants exported.

Twelve pounds of Brucea seed were supplied to Messrs. BURROUGHS and WELLCOME, and a quantity of bark of *Roucheria Griffithiana* to Buitenzorg for investigation.

Experiments in packing Durian seed for export to long distances were made. This seed is a very bad traveller, and though in much demand for other Colonies it seemed impossible to get it to them in a fit state for germination. A number of seeds were sent to West Africa packed in various ways. It was found thus they travelled best dry with no packing at all, over 90 per cent germinating on arrival.

Exhibitions.

A number of specimens of Rubber, living plants of *Hevea brasiliensis*, trunks of trees showing tapping, and specimens of flowers and fruits, etc., of Para Rubber were sent to the International Exhibition in London in the Autumn where they attracted much remark. Mr. R. DERRY at home on leave represented the Colony and took charge of the exhibits.

The Agricultural Exhibition was held this year at Kuala Lumpur, and the Director visited it.

Coconut Trees Inspection.

The red beetle seems to have got quite scarce among the estates and most of the harm is now done by the black one. These, however, seem quite to have disappeared from the vast accumulations of sawdust at the sawmills in Rochore, where they formerly bred in myriads and gave some trouble as it was impossible to destroy the immense amount of sawdust, in which they bred. Much of this ground has now been built over, and the beetles seem to have entirely disappeared; another kind of beetle was found in some trees with the black beetle; a large species of *Elater*. Only a few were found and these had apparently entered the burrows of the *Oryctes* to feed and are probably harmless.

**REVENUE AND EXPENDITURE OF THE BOTANIC GARDENS, SINGAPORE,
FOR THE YEAR 1908.**

REVENUE.				\$	c.
By balance in Bank on 1st January	...	...	...	2,539	41
By Government Grant	...	...	...	8,000	00
By sale of Prepared Rubber	...	...	...	2,756	16
By sale of Plants and Seeds	...	...	...	7,327	80
By balance on the account of prepared rubber sale on					
1st January, 1908	...	...	...	6,404	67
Interest	...	...	...	62	14
Total				27,090	18

EXPENDITURE.				\$	c.
Salaries of Garden Employees	...	...	...	7,414	89
Bills on Gardens Account	...	...	...	10,724	22
Purchase of Tools, etc., through Crown Agents	...	...	...	492	75
Expenditure from Rubber Sales Account	...	...	...	6,982	71
Balance in Bank on 31st December	...	...	...	1,475	61
Total				27,090	18

BOTANIC GARDENS,
25th March, 1909.

HENRY N. RIDLEY,
Director of Gardens, S. S.

Annual Report on the Botanic Gardens, Penang, 1908.

Staff.

1. Mr. DERRY was in charge till the end of January when I came up from Singapore on the return from leave of Mr. RIDLEY, and resumed my substantive appointment. The only other change was necessitated by the breakdown of the Clerk, Mr. AERIA, who was more or less ill for some months; he took leave for six weeks and was temporarily replaced by Mr. INGRAM.

The health of the coolies has been fairly good, with perhaps fewer cases of Fever and Diarrhoea than usual. Several cases of Beri-beri occurred.

Weather.

2. The year under review has been a very wet one. The rainfall returns show that over 111 inches fell on the plain and 171 inches on the Hill against 124 inches on the Hill last year and 70 inches on the plain. September was the wettest month and January the driest. Appended are the Returns for the year. On the 26th of September was experienced the most destructive storm for many years past. The roads were blocked in many places owing to the numbers of trees blown down, four large trees were blown down in the Gardens which is comparatively sheltered. The fallen trees included a fine Norfolk Island pine over 70 feet tall. On the same date no less than eight inches of rain fell. The effect of the heavy rains on our hilly roads entailed an unusual amount of labour in keeping them in repair, and in many cases the entire labour staff did nothing else for days but repair the roads, so great was the scouring.

The Year's Work.

3. Naturally after my long absence (nearly two years) I found some arrears of work; much credit is due, however, to Mr. DERRY who worked hard in bringing the Gardens back to efficiency after they had been without a Superintendent for a year,

the aroid ravine which he started and the improvements in the landscape of the lower part of the Garden being noticeable. In both cases these have been extended during the year. The chief work, however, has been the establishment of a nursery for the propagation of plants of a decorative character.

4. Prior to going on long leave in 1906, I applied to Government for authority to purchase an acre of land on the right at the entrance to the Gardens from the Hindu Trustees. This was granted but nothing was done until my return. The work of clearing, felling and getting the ground prepared into nursery beds occupied the first half of the year. During the latter half some thousands of young plants have been reared and are now available for sale and to replenish our own depleted stock. Provision has been made to reserve a portion of the nursery for the propagation of our best fruit trees, and plants of an economic interest. I hope soon to be in a position to supply these plants which hitherto we have not been able to do. The small plot of ground near the stable has been made into a palm nursery exclusively.

The fern rockeries started in 1904 have had small but important additions of rare ferns added to them. The plants have grown well and this portion of the Gardens is the coolest and most pleasant especially in the middle of the day.

Upkeep and Buildings.

5. Four out of the six plant houses have had their roofs entirely renewed. The Begonia House near the entrance has been re-covered with rubberoid and partly with bertam rods. The plants had suffered so much from the excessively wet year that it was absolutely necessary to reconstruct the roof to give them the requisite shelter, and I am glad to say that the result has been entirely satisfactory as the Begonias are much improved in appearance. The large iron house although covered last year with bertam chicks suffered so much damage from the storm in September that it was found necessary to replace the chicks with split bertam rods which are much stronger than chicks and moreover much cheaper as they were obtained from the jungle by our men. The palm house near the nursery sheds has been similarly covered and the posts and beams renewed where necessary. The summer house was reattaped during the year.

A new stone culvert leading from the band-stand road to the stream was made, to carry off the storm water that had hitherto found its way over the grass leaving numerous debris in its course. Two new plant stages faced with stone were made near the potting sheds. The dam of the lily pond was raised, the pond cleaned out and some *Nymphae* planted; I regret to say that all the plants were eaten by a kind of slug which nibbled off the leaf stalks.

The Public Works Department erected new quarters near the Coolie Lines for the Sub-Overseer and Tindal.

Library and Herbarium.

6. The remarks made in former Reports with reference to the difficulty of keeping the Herbarium free from damp during the wet weather held good to a greater degree than before, the only method of drying being the charcoal fires which had to be kept going almost continuously during the latter half of the year.

The natural order Anonaceae was loaned to the Director, Singapore, and I have had an application from Mr. GAMBLE who is editing the "Materials for a Flora of the Malay Peninsula" (Dicotyledons) for the loan of specimens belonging to the natural orders in the Apetalae and Gymnosperms, these will be despatched early in 1909. I was not able to make any botanical tours but I obtained permission for the Overseer to visit the Perak Hills. He brought back with him an assortment of Ferns, Aroids, and Orchids.

The usual periodicals have been received and those of the previous year have been bound as also were some other books of reference that required it. Several text books were purchased among them being the latest edition of HERBERT WRIGHT'S work on Para Rubber. Thanks are due to the Government of India for the presentation of Volume VI, Part II of the Annals of the Botanic Gardens, Calcutta, and to the authorities of the Science and Forestry Bureau, Manila, for their valuable publications.

Exchanges of Plants and Seeds.

7. Owing to the absence of any collecting trips for the past two years, and also to the increasing difficulty in finding new plants of a novel type suitable for exchange our receipts have not been so great as they were three years ago. Seeds have been sent to other Botanic establishments as they have ripened. Among the

seeds received from the Royal Botanic Gardens, Kew, were a thousand each of the two new varieties of Manicoba Rubber. Of the variety called "Jiquie" *Manihot dichotoma* 202 seeds germinated, whilst of the variety "Remanso" *Manihot Piauhyensis* out of a similar number of seeds only 12 have germinated so far. These two rubbers are fully discussed in the "Kew Bulletin" No. 2 for 1908 and are said to be infinitely superior to "Ceara Rubber" (*Manihot Glaziovii*). As regards their suitability for this country it is hardly likely that they will seriously compete with *Hevea brasiliensis*, for not only is the rubber from the last-mentioned species better, and fetches a higher price to the extent of nearly sixpence per lb., but the former is essentially a rubber adapted for a drier and less fertile country than the Malayan region. That it is to be reckoned with however as regards the world's supply of rubber is shown by the fact that according to the "India Rubber World" a German Company has bought 800,000 acres in Bahia with the intention of planting these rubbers; and other Companies are being formed for its cultivation. It is, however, important to have another species of rubber on hand in case of disease on a large scale attacking the Para, and I propose planting out the young stock now on hand as possible seed suppliers of a future date.

Para Rubber.

8. The two chief estates in Province Wellesley, Caledonia, and Bertam are going steadily and increasing their acreage; and on the Island it is noticed that some of the Chinese spice planters are planting up Para where once nutmegs and cloves were grown. The old tree in the Gardens was again tapped during the year and yielded 3 lbs. 8 ozs. of dry rubber making the total yield since the first tapping over 40 lbs. A photograph of this tree was sent to the Rubber Exhibition at Olympia together with the actual rubber it had produced. Unfortunately the rubber obtained from it some years ago had not kept well but had become very black and tacky and consequently when it was sold at the close of the show it could only be classed as "rejections" and brought only \$37.03. The exhibit nevertheless created a good deal of interest.

Sale of Plants.

9. These fell off considerably during the year owing partly to depleted stock and partly to the fact that last year a larger number than usual of the kinds of plants sold such as Ferns, Begonias, Palms, etc., was purchased which checked the demand this year. The amount realized \$375 as against \$1,111 last year.

Governor's Hill Garden.

10. Notwithstanding the usual unsatisfactory labour supply and the excessive rainfall 171 inches, the plants and grounds were maintained in an efficient condition and Mr. FERNANDO deserves credit for the neat appearance of the grounds. Mr. CURTIS presented a hundred bulbs of tuberous-rooted Begonias and Messrs. HERB of Naples a collection of bulbs which have been potted up for experiment as to their suitability for the Hill.

Coconut Trees Preservation.

11. The appointment of a Sub-Inspector of Coconut Trees made last year has been entirely satisfactory. He is stationed on the Island thus allowing the Inspector to devote the whole of his time to Province Wellesley. It is now possible for the Districts at the back of the Island to be visited properly and regularly, a thing impossible before. From the Returns appended it will be seen that on the Island 328 notices were issued calling on owners to destroy 371 dead trees, 594 trunks, and 35 heaps of manure. There was only one prosecution; owners readily complying with the notices served on them. The difficulty, however, in the case of the small holdings, is to find the owner.

In the Province 316 notices were served to destroy 338 dead trees, 980 trunks, 39 heaps of manure, and four heaps of paddy husks. There were three prosecutions during the year with small fines amounting of \$7.50. On the whole the Province is fairly free from beetle attack, the District most attacked during the year was from Sungai Nior as far as Simpa.

General.

12. I attended the fifth joint Agricultural and Horticultural Show which was again held at Kuala Lumpur in August, the first of the series having been held there in 1904. On the whole the Show was a good one, far more so than the comparatively local Show held the year previous at Kuala Kangsar. To the trained eye, however, one or two Divisions were weak, markedly so, in the Horticultural section. Penang

and the Province again scored heavily taking one silver cup won by LOW CHIT MUN, Balik Pulau, for best collection of cultivated fruits, 53 1st prizes, 43 2nd prizes, 20 3rd prizes, 8 silver and 3 bronze medals; the amount of money prizes won by the Penang Contingent was \$364. The classes in which Penang won easily were as usual spices, fruits, and oil. By the kindness of the Hon'ble Resident Councillor and on the invitation of Dr. BUSSY, the Honorary Secretary of the Agricultural Division, I attended the Grand Industrial and Agricultural Show held in Deli at the end of August and beginning of September. As I have submitted to Government a special Report on my visit, it is only necessary to say here that I gained considerable instruction from my visit.

Angsenna Trees Disease.

13. For the past two years an obscure disease has been attacking the Angsenna trees along the road sides. These trees are quite a feature of Penang and whether covered with golden bloom, or out of flower with their graceful foliage, are alike of conspicuous beauty. Any serious damage to them is of the greatest importance; up to the present over 50 large trees have succumbed to this disease, attempts have been made to check it by digging trenches round affected trees, and treating with sulphate of copper and lime. On my representation the Municipal Commissioners arranged for Mr. GALLAGHER, the Government Mycologist of the Federated Malay States, to visit Penang and report on them; I showed him the attacked trees, and gave him a history of the cases and together we examined the roots. Mr. GALLAGHER has succeeded in finding the hyphæ of a fungus in the cell tissue from which he is trying to make cultures. He has submitted a preliminary Report, but, until his investigations are complete, it will be necessary to wait for his recommendations for the eradication of the disease. It is surmised that this is the same disease that carried off the magnificent Avenue of the same tree which adorned the sea shore in Malacca some 30 years ago.

A statement of the *Expenditure is attached, and the usual Rainfall and other *Returns are appended.

W. FOX,

Superintendent, Forests and Gardens, Penang.

Abstract of Rainfall for the Fort, Government Hill, and the Prisons during the Months, January to December, 1908.

MONTHS.				Fort.	Prisons.	Government Hill.
January	...	...	...	1'45	2'40	6'53
February	...	...	...	4'56	3'72	5'78
March	...	...	...	4'81	3'81	8'81
April	...	...	...	5'83	8'93	14'95
May	...	...	...	8'54	15'53	20'30
June	...	...	...	6'87	10'42	14'68
July	...	...	...	6'13	7'06	10'56
August	...	...	...	14'55	14'66	15'75
September	...	...	...	33'70	25'54	40'94
October	...	...	...	12'24	10'17	16'82
November	...	...	...	5'91	4'23	11'18
December	...	...	...	6'74	4'79	4'90
Total ...				111'33	111'26	171'20

* Not printed.

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command of
His Excellency the Governor.

Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1909.

Staff.

There were no changes in the staff during the year. The coolies worked fairly well, and there was no sickness excepting a little mild fever.

Visitors.

The usual large number of Botanists and Agriculturists from all parts of the world visited the Gardens, as well as many planters from the Federated Malay States and elsewhere. In December a large number, some hundreds of American tourists who were travelling round the world, visited the Gardens, and expressed much satisfaction with what they saw. Among the better known visitors during the year were M. A. PRINZHORN (Hanover), Count DE KERCHOVE DE DENTERGHEM (Ghent), Mr. and Mrs. ISENBERG (Honolulu), Mr. M. L. MERRIT (Forestry Department, Manila), Prof. D. MAGNUS (Berlin), Dr. P. J. CRAMER (Buitenzorg), Dr. BERKHOUT (formerly of the Forest Department, Java), MAX FLEISCHER (Berlin), Mr. SANDEMAN (Berlin), Dr. FUJINI, Prof. I. IJAMA and Prof. SUKETERU KIKKAWA from Japan, M. DUWEL (from Algiers), M. DULAC (Botanic Gardens, Saigon), Mr. S. DUNN (Botanic Gardens, Hongkong), Mr. and Mrs. TALBOT-CLIFTON (Lytham Hall, Lancs), Miss GIBBS, Mr. GARDENER (Jamaica), Mr. EARLE (Boston, U.S.A.).

The Band of the Middlesex Regiment played by moonlight on many occasions, and the Fifes and Drums every Wednesday before sundown. This was very popular with the children, who attended in great numbers.

Motor cars are admitted to the Gardens under regulations, and there has been cause for but little complaint. A few have proved a nuisance to other visitors by smoking, a matter remedied by ordinary care by the chauffeur, and except in wet weather seem to do but little harm to the roads. In most Botanical Gardens it appears they are not admitted at all. There were no thefts of any importance.

Roads and Drains.

The heavy rains during January to March hindered work considerably, and damaged the roads and paths considerably. By substituting brick drains for the old mud drains much of the denudation damage is prevented, and the roads are not only made better but are much less expensive to keep up. During past years, whenever funds would permit, the plan of brick draining all roads liable to heavy wash of rain has been carried on gradually, and there are now left very few roads which require this. Four hundred and sixty-four yards of brick drain, varying from 18 inches wide and seven inches deep to eight inches by six, were built during the year. The larger part of this was the drain running through the palm valley. The drain behind the band-stand was altered and a new catch-pit built. An extra catch-pit was built at the upper end of the lake, where the drains from the roads enter the Garden, and the open drain thence to the lake was piped. This has given a great deal of trouble, as the water brings down a large quantity of silt off the roads which is eventually carried into the lake, silting it up. Various attempts have been made to obviate this, but though improved the condition is not yet quite satisfactory. The Rogie road was patched and gravelled and the side drains re-opened, and the long border road, Garden road, terrace paths, road to store, and other roads re-metalled, raised or gravelled. The band-stand paths were covered again with sand for the benefit of the children who play there.

A side path leading to the barrack grounds was closed and turfed over, and the fence closed at that point. It was seldom used, and nuisances caused by the 'rikisha coolies stationed outside were thus stopped.

Buildings.

A large *Spathodea* tree fell during the night of November 8th on the potting shed, and completely destroyed three-quarters of it, which had to be rebuilt. The tool-shed was repaired and enlarged. A new soil-shed was built. A small cement

tank for germinating aquatics was made and has proved very useful. The new seedling sheds were built, which proved very useful. The glass houses have been most successful, a number of plants, and notably succulents and gloxinias, are now cultivated with ease and in considerable numbers, a thing impossible before.

Beds and Borders.

The borders along the long border road were entirely renewed, re-trenched, manured and replanted with foliage and flowering plants, and have proved one of the great attractions of the Garden. The borders of the road leading from the terraces to the plant sheds was also entirely remade, and a rockery of coral made on each side, which was planted with small foliage plants, many of them rare and beautiful plants from Borneo and the Peninsula. This rockery border has been very much admired. The ginger border leading from the plant-house to the sheds was re-dug and entirely replanted, as were the Tyersall border and the *bromeliad* beds. The border between the main road and the old cement tank was replanted to hide the tank from the road. This tank is used now as a manure pit. A new border was made between the sloping lawn and the nurseries and makes a bright feature in this part of the Gardens. Many of the larger beds were re-trenched and manured and re-planted, and all the palms and specimen plants were manured. Over 200 palms were planted in the palm valley. The collection of palms now is probably one of the largest in number of species of any garden in the world.

A large piece of secondary scrub below the Assistant Curator's house was cleared and turfed.

Plant-Houses.

The flower house was kept bright throughout the year, and was very attractive. Flowers in this part of the world last for a very much shorter period than they do at home, and this entails a great deal more work in keeping the house bright than would be the case in an English hot-house, as constant renewal is necessary.

A superb exhibition of Burmese *dendrobiums* which was on view from January to February attracted many visitors, whose attention was called to it by mention of it in the local papers. The *adiantums* also were highly admired, and an article on the cultivation of these plants published in the "Bulletin" stimulated the demand for these ferns.

A small collection of *mamillarias* and other succulents, mostly presented, was also a source of interest.

Deaths from Lightning.

Three valuable trees were killed by lightning during the year, the storms being unusually severe. One of these was the fine *Shorea leprosula* near the band-stand. This tree was 150 feet tall and 10 feet 3 inches girth at 4 feet from the ground, and was one of the show plants of the Gardens. It was connected with an adjoining *Terminalia subspatulata* by a liana of *Spatholobus*. The portion of this connecting the two trees was killed as well. The *Terminalia* though touched by the lightning was unhurt. The *Shorea* slowly died apparently from shock and was felled some months later. Shortly after this the best durian tree in the Gardens, near the stables, was killed instantaneously by a flash of lightning. This tree used to produce as many as 30 durians a day during the season.

The fine *Sindora wallichiana* on the lawn by the lake was found to be quite dead towards the close of the year and though it bore no lightning marks, no other cause of death could be suggested.

New Ornamental Plants.

The collection of maidenhair ferns was increased, and large stocks kept up to meet the demand. Six new hybrids were obtained this year and named, respectively, *Beauty of Singapore*, *Bidadari*, *Tanglin*, *Mrs. Napier*, *Standard*, and *Shamrock*. The *adiantums* are raised from spores by sprinkling the spores on the coral tables on which the pot plants are grown; the spores germinate, and in the prothallus stage occasionally become cross fertilized, and hybrids are thus produced; of the new hybrids the *Beauty of Singapore* is perhaps the finest and has been much admired. *Standard* and *Shamrock*, the latter with three-lobed leaflets, are quaint and commendable.

A paper on the cultivation of ferns especially *adiantums* was published in the "Bulletin" and was in much demand by cultivators of these popular plants.

Among the ornamental foliage plants introduced was *Phrynium Jagoratum* from Temango, Perak. *Strobilanthes albostratus* introduced by the Director from Telom, Perak, last year was propagated and found to be easy of cultivation and to form an attractive pot plant; the leaves of a dark green are veined with white above and deep purple beneath.

A small collection of *cacti* was obtained from Mr. TAN BENG CHIANG and proved very attractive. Large numbers of succulents were raised from seed received from La Mortola in the glass houses chiefly *Gasteria*, *aloes*, etc.

It is not at all easy to grow succulents in this wet country, but under glass they can be raised, and, being kept in the drier parts of the plant-house, may do very well.

A fine series of new *cannas* was presented by Father GEX containing many handsome forms.

Mussaenda erythrophylla was magnificent all through the year and was in much request. *Hosea lobbiania*, a most beautiful and striking plant from Sarawak, was remarkably showy, and numerous cuttings were made from the two plants in the Gardens, and it is hoped to distribute this superb climber this year.

A fine show of *achimenes* was staged in the flower house in May, and the exhibition of Burmese orchids in the early part of the year was the finest for very many years and attracted a large number of visitors.

During the year 384 plants were presented and 759 bulbs and other plants purchased, and 640 packets of seeds were presented, and 150 packets purchased. The donors were Mr. MICHOLITZ, Mr. MANNERS (Tirhoot), R. LITTLE, M. ROBERTSON-PROCHOWSKY, Messrs. HERB, M. BUYSMAN, PEREIRA, TRELEASE, MACHADO, TAN BENG CHIANG, M. ISENBERG, Mr. LONG, Messrs. WILLIAM BROS., A. BURN-MURDOCH, LEWIS, Colonel MURRAY, Mr. MARSHALL (Brunei), Mr. HOBSON, Father GEX, and the Botanic Gardens of Cambridge, Buitenzorg, La Mortola, Mauritius, Durban, Yokohama, Manila, Kew, Washington, Berlin, Jamaica, Hanoi, Seychelles, Sydney, Grahamstown, Costa Rica, Calcutta, Taiping, Kwala Lumpur, Albany, Trivandrum, and U. S. A. Department of Agriculture. Among the most important introductions were the Zapupe, *Gomphocarpus semilunatus*, *Machilus nanmu* (the Chinese Coffin tree), *Bleekrodea tonkinensis*,—Tonkin rubber, *manihot dichotoma*, *heptaphylla* and *piauhyensis*, *Piper longum*, Costa Rica coffee, a new fine large series of succulents from La Mortola, and some new *cannas* from Father GEX.

Plants Exported.

One hundred and thirty plants were sent to Kew, Taiping Gardens and elsewhere, and 315 packets of seed chiefly to the West African Colonies, Honduras and Christmas Island.

New or Noteworthy Plants.

The following plants flowered or fruited for the first time in Singapore:—

I. Malay Peninsula.

Didymocarpus ascendens.—Tapah.

Disporum pullum.—Telom, Perak.

Bulbophyllum trichoglottis, *n. sp.*—Telom, Perak.

Do. *coniferum*, *n. sp.*—Telom, Perak.

Sarcochilus anceps, *n. sp.*—Johore.

Begonia pavonina, *n. sp.*—Johore.

Begonia robinsonii, *n. sp.*—Johore.

Do. *roxburghii*.—Johore.

Staurogyne arcuata.—Johore.

Impatiens sarcantha, *n. sp.*—Johore.

Do. *exilipes*, *n. sp.*—Tapah.

Lepidagathis wightii.—Johore.

Eria bidens.—Perak.

Sarauja tristyla.—Kelantan.

Collabium nebulosum.—Gunong Kerbau, Perak.

Bæica, *n. sp.*—Gunong Kerbau, Perak.

Cardiopteris lobata.—Perak.

Zalacca wallichiana.—Fruited (Singapore.)

Flectocomiopsis scortechinii.—Singapore.
Iguanura malaccensis.—Fruited (Singapore.)
Raphidophora beccarii.
Aeschynanthus stenophylla.—Johore.
Bulbophyllum flammuliferum.—Johore.

2. **Malay Islands.**

Coleospadix oninensis.—New Guinea.
Impatiens holstii.
Pinanga arundinacea.—Borneo.
Desmanthus virgatus.

3. **India.**

Licuala peltata.
Ptychoraphis augusta.
Eranthemum wattii.

4. **Africa.**

Kigelia pinnata.—(Fruited.)
Crinum giganteum.—Accra.
Tabernanthe iboga.
Asparagus madagascariensis.
Gomphocarpus (asclepias) semilunatus.
Pachyrrhizus angulatus.
Pavetta caffra.
Garcinia livingstonei.—(Fruited.)

5. **Europe.**

Myosotis welwitschii.
Dianthus capitatus.
Lupinus hirsutus.
Solanum villosum.

6. **China.**

Rehmannia angulata.
Perilla laciniatus variegatus.
Perilla gigantea rubra.

7. **South America.**

Pogonopus exsertus.—Mexico.
Catasetum tridentatum.
Angelonia grandiflora var alba.
Diacrium bicornutum.
Gliricidia maculata.
Castilleja elastica.—Flowered and fruited.
Tropæolum minus.
Zea mays quadricolor perfecta.
Solanum villosum.
Epidendrum ciliare.
Prestœa montana.
Cosmea sulphurea.
Erythrina aurantiaca.—Introduced in 1888 (FERNANDO DE NORONHA.)
Nicotiana glutinosa.
Heliconia psittacorum.—Guiana.
Couroupita guianensis.—Cannonball tree.

Expeditions.

The Director visited Penang in the early part of the year and in July went on an expedition to Temengoh in Upper-Perak, with Messrs. ROBINSON and KLOSS. The locality was unhealthy and there was much sickness in the expedition, but a good

number of new and interesting plants were obtained. The most important was a new species of *Stichoneuron* (*Roxburghiaceæ*); the only species previously known was a Himalayan one. The locality was richest in *Acanthaceæ*, a number of novelties being obtained. About fifty new species of plants were collected and some living plants of cultural interest obtained. It was intended that, after returning from Temengoh, the Director should attend the Agri-Horticultural Exhibition at Penang and go on to collect the flora of Setul, this northern Peninsula region being almost unknown botanically, but unfortunately he was unable from fever and poisoned wounds to progress further, and after a stay of a fortnight in Taiping Hospital returned to Singapore. The plant collector during the stay at Taiping collected many plants, some of importance, in the hills, and besides collecting at Temengoh, made a considerable collection at Lenggong on the return journey, where the limestone rocks provided a considerable number of additions to the flora.

Herbarium.

The Herbarium was largely increased during the year and the Director worked through the collection, making a record of localities and distribution numbers, and recording species not included in the materials for a Flora of the Malay Peninsula, with additional notes on points of importance not previously recorded. This work, which occupies a long time, owing to the great amount of material, was finished as far as the end of the *Polypetalæ* by the end of the year.

The *Piperaceæ* which had been sent some years ago to M. C. DE CANDOLLE for identification were returned and a considerable portion of new species found to be among them.

Considerable additions to the herbarium were made from the Director's expedition, and specimens from the Malay Peninsula were made by Mr. BURN-MURDOCH, Mr. HOBSON, Mr. KLOSS (120 specimens) and, from the Calcutta Herbarium, Malayan and Indian plants (318).

From Borneo Mr. C. J. BROOKE presented 13 specimens, from Bidi, Mr. MOULTON, Sarawak Museum, (25), Malay Islands, ZOLLINGER, CUMING, etc., from the British Museum (93), Buitenzorg Herbarium (128), Philippines, Mr. W. T. HUTCHINSON (840). There were sent out of duplicates to the British Museum (1,504 specimens), to Kew (664), Manila (223), Calcutta (399), Berlin (587), Buitenzorg (150), Dr. CHRIST, Ferns for identification (83), Prof. BECCARI, Palms for identification (4), Mr. LILLY, Mosses for identification (79).

The Herbarium is indebted to Dr. CHRIST and Colonel BEDDOME, Prof. BECCARI, Mr. BROTHERRUS, Mr. MATTHEW, Mr. MASSEE and others of the Kew Gardens staff and M. DE CANDOLLE for identification of difficult groups.

Library.

The usual large numbers of journals and pamphlets was obtained from various Botanic Gardens and Institutions in exchange for the "Bulletin," and a few journals and books purchased, and a large number were bound. Of presentations the most important were the "Annals of the Botanic Gardens, Calcutta;" volume of *Calameæ* by Dr. BECCARI; the "Flora of Tropical Africa," vol. XI, Royal Gardens, Kew; "Notice sur les plantes interessantes de la Flore du Congo," by E. WILDEMAN.

Publications.

The "Bulletin" was published regularly throughout the year and there was a considerable increase in the number of subscribers. It was found advisable to transfer the seat of its printing to the office of the "Straits Times" mainly with a view of securing more advertisements. The grants of the Government and Federated Malay States, and the subscription from planters and others, are quite inadequate to pay for the cost of printing, postage, etc., and the reserve fund was drawn on for the deficit. This, however, was being rapidly depleted, and without the aid of advertisements it would have been necessary for its publication to cease in two or three years. The Director published with notes a manuscript of the plants and cultivation of Prince of Wales Island, written by Surgeon HUNTER in 1806, giving records of the first fruiting of the nutmeg and the early cultivation of the pepper and gambir in Penang. The manuscript was found in the British museum, and published in the "Journal of the Straits Branch of the Royal Asiatic Society." The paper on Philippine *Scitamineæ* referred to last year was published. The types of this paper are in the Botanic Gardens herbarium.

An account of the Flora of the Telom valley expedition in 1908 is being printed off in the "Journal of the Federated States Museum." The account of the Flora of

Temengoh collected this year was compiled and will shortly be published. A further instalment of the new plants of the Malay Peninsula has also been printed in the "Journal of the Royal Asiatic Society, Straits Branch."

An article on the relationship of ants to plants has been written and sent to be printed in the "Annals of Botany." In the Kew "Bulletin" (1909-5) Mr. G. MASSEE of Kew described 17 species of fungi new to science (*Boleti*), found in the Botanic Gardens, Singapore, and preserved in spirits, with coloured drawings made by the Garden Artist in 1907.

A new fungus attacking the shoots of para rubber trees and eventually killing the tree was sent to Kew and identified by Mr. MASSEE as a species of *Diplodia*, and an account of it was published in the "Bulletin."

A plate and account of *Peliosanthes violacea*, var. *clarkii*, sent to the Botanic Gardens, Kew, appeared in the "Botanical Magazine." A note on the fruiting of *Burbridgea* was also published in the "Journal of the Straits Branch of the Asiatic Society."

The botanical lectures to the medical students were given by the Director at the Medical School from September to December.

ECONOMIC GARDENS.

Buildings.

During the year a large rubber-curing shed was built, several new seedling sheds and the old nursery sheds were also rebuilt. The wood for the smaller works was obtained in the Gardens. All the atap buildings were re-covered.

Extension Work.

A considerable area was cleared and planted with a collection of leguminous plants, *crotalaria*s, *tephrosia*, *desmodium*s, *cajanus*, *clitoria*, etc., all plants known to be valuable as nitraginous plants and suitable in various degrees for covering and improving the soil of rubber and other estates. There was a considerable demand for seeds of all these plants.

A considerable area was prepared for pepper planting and planted through with betel-nuts to serve as supports.

A path was cut round the ground parallel to the Cluny and Bukit Timah Roads so as to get quickly round the rubber plantation to the end of that part of the Garden. It was hedged from the road with *coca* (*Erythroxylon coca*) and *Hibiscus*; a *coca* hedge was also run from the coolie lines to the entrance of the Economic Gardens.

Maintenance.

The greater part of the work with the small staff allowed is naturally upkeep or maintenance of the ground opened in an ordinarily presentable and decent condition. All the stock plants of *sansevieria*, *ramie*, nutmegs, cloves, gutta-percha, rattans, citronella and lemon grass were re-dug, cleaned, and in some cases replanted. A great deal of work was done in cleaning and deepening drains, planting and weeding intermediate crops in the plot lying between Cluny and Bukit Timah Roads, where there are 526 trees of para rubber, of which many will be tappable in a year's time. A great deal of time was occupied in mowing and cutting grass under the rubber trees in order to gather the seed crop and also in the arboretum which had got much overgrown. A number of old dead or useless trees were removed and the stumps dug out.

A large number of useful plants were raised from seed for export or planting out, and many young trees, camphor, cloves, *ficus elastica*, gutta-percha, etc., planted out. Several thousands of seeds of fruit trees and other plants in demand were planted for stock.

Arboretum.

Part of this, the section including the orders from *Nyctagineæ* to *Urticaceæ*, was manured, the trees cleaned and a number of additional ones added. The ground was mown also several times. But the press of the work prevented as much as being done here as was hoped.

Demand.

The chief demand for plants other than rubber was for fruit trees and ramie and for nitrogenous plants. With the present boom in rubber planting it is not to be expected that planters will pay attention to anything else. However, it is essential to keep up a good stock of all economic plants likely to come into demand.

Rubber Seeds and Plants.

The demand for seeds from the old trees of the Gardens still maintained its height, and there was no difficulty in selling all that were procurable, 271,000 seeds were sold from the garden and 102,300 were purchased from outside. The price of the garden seed, viz., ten dollars a thousand, was maintained, although seed from estates was selling at a much lower figure. The chief recipients of the seed were:—the Governments of Papua, British Guiana, British Honduras, Dominica, and Sierra Leone, the Liberian Corporation, Mabira Forest Rubber Company, Kelantan, and Singapore plantations. Of para rubber seedlings 20,500 were also sold locally.

The collecting of the seed, packing, export and all the business connected with this trade is naturally a great strain on the staff, and much ordinary work had to be put aside for it. However, it is only by such sales that the gardens can be kept up at all. The whole rubber ground had to be mown twice during the year employing the whole time of most of the men for a long period, and seed collectors and packers were employed for a considerable period every month. The floods were more frequent this year than formerly for some unexplained reason, entailing more maintenance of paths and drains and more constant weeding in the rubber ground.

General.

The balance at the end of the year appears to be a large one, but it must be remembered that the gardens are to a large extent maintained by sales and that the money thus received does not come in till towards the end of the year. It is therefore essential to have a balance sufficient to maintain the Gardens in the first half of the year. The Government grant for upkeep, \$8,000, pays only for the minimum amount of labour required to keep the Gardens in a respectable condition, all improvements, tools, stores, etc., have to be paid for by sales. The revenue thus obtained is received from sales of para rubber seeds, crude rubber made during experiments, and a little from sales of ornamental plants, etc. The rubber seed has hitherto been sold at ten dollars a thousand, and to the present date there have been sufficiently large orders to take all the seed we have. Plantation seed, however, is so abundant and for sale at so low a price, that we could not maintain the high price of the garden seed were it not for the great reputation it has got. The sale of para rubber seed at any price which would pay is not likely to continue much longer and perhaps in a year may cease to be a source of revenue to the Gardens. Sales of other economic and ornamental plants bring in a revenue which is practically negligible, and is also very unreliable. In past years it has fallen as low as three hundred dollars in the year.

The only thing left is the sale of crude rubber to make up a deficit of at least four thousand dollars a year on the most economical lines. This source of revenue it might be suggested might be increased by concentrating the work of the staff on the ground as a rubber plantation. But this would be very inadvisable. The competition of a Government gardens with outside plantations has long been shown to be eventually a disastrous failure in every case. The staff instead of doing its legitimate work in aiding by experiment and propagation the agriculture of the country, would be employed as planters only, for it would be impossible to carry on both works at the same time and the trees now valuable for experiments would probably deteriorate and in any case be spoilt for research work.

At the present time the Department is making as much revenue as can be made by its sales of rubber seed in order to be prepared at a later date to continue its work by what may be called a reserve fund when the sales fall off. This is the reason for so large a balance at the end of 1909.

BOTANIC GARDENS, SINGAPORE, REVENUE AND EXPENDITURE FOR THE YEAR 1909.

REVENUE.			\$	c.
By balance in bank on 1st January	...	...	1,475	61
Government Grant	...	...	7,950	00
By sale of Seeds and Plants	...	...	4,303	55
By sale of prepared Rubber	...	...	3,843	48
Bank Interest	...	...	35	92
Total			\$17,608	56

EXPENDITURE.					\$	c.
Salaries	...	...	...	...	5,994	34
Bills	...	...	...	...	7,221	05
Crown Agents	...	...	...	...	315	79

EXPENSES IN CONNECTION WITH RUBBER TAPPING.

	\$	c.
(a) Salaries	1,414	19
(b) Buildings, Acid, Mangle, Plates, etc.	702	90
Balance in bank on 31st December	1,960	29

Total ... 17,608 56

BOTANIC GARDENS,
19th April, 1910.

HENRY N. RIDLEY,
Director of Gardens, S. S.

Annual Report on the Botanic Gardens, Penang, 1909.

Staff.

The only changes in the staff was the resignation of Mr. RATNA RAJ, the Assistant Overseer, who obtained a better position in the Public Gardens, Kuala Lumpur. He was replaced by MAHMOOD, from the Telephone Office. The Clerk, Mr. AERIA, died on March the 10th and was replaced by Mr. L. S. INGRAM on March the 9th. The health of the coolies was better than usual, and this I attribute to better housing arrangements.

Weather.

The year under review was even wetter than 1908, which was characterized as a very wet one, the rainfall at the Criminal Prison being no less than 130 inches, as against 111 inches in 1908, and 70 inches in 1907; out of this total 58 inches fell in September and October. The result of this abnormal fall was disastrous. The enormous volume of water rushing down the waterfall stream carried away two of the weir dams, and making fresh channels wore away the banks bringing down several large trees, and many smaller shrubs. The canna beds planted near the stream were entirely washed away, and tons of boulders and sand strewn over the lawns on the right and left banks of the stream.

Roads and Paths.

As usual these suffered severely during the heavy rains and it was not until the end of the year that the necessary repairs were effected.

The Year's Work.

No new work of importance was undertaken during the year, chiefly on account of my time being taken up with organizing the Agricultural and Horticultural Show as Honorary General Secretary. The first meeting in connection therewith was held on January the 15th and from that date onward, I attended every meeting except one, (when I was ill) of the General Purposes Committee, and the various Sub-Committees, till December the 16th, the date of the last one. When it is mentioned that there were nearly two thousand exhibitors, it will be understood that the correspondence in connection therewith was very heavy. Special efforts were made to have as large a collection of flowering plants as possible from the Gardens at the Show. These were grouped in various parts near the entrance and were duly admired especially the white *Cleomes*.

It is satisfactory to record that the Show was considered one of the most successful of the series. I submitted a separate report on the Show to the Government.

The chief work involving the most labour was the removal of the avenue of rain trees from the entrance gates to the office; these trees had become old and worn out, besides which they were spoiling the permanent avenue of *Polyalthia* trees planted between them.

The ordinary routine of manuring and renewing the beds and borders was attended to.

Upkeep and Buildings.

The fern-house was entirely re-roofed during the year, and the side tables replaced in stone with cement facings. The Public Works Department erected new quarters for the overseer and watchmen at the Chetty Temple Nursery.

Library and Herbarium.

The whole of the Herbarium specimens were gone over and poisoned and restrapped where necessary. The excessive rainfall necessitated the daily use of charcoal fires to keep out the damp. Duplicates of the division of the *apetalæ* comprising 29 natural orders, were forwarded to Mr. GAMBLE at Kew in connection with the flora of the Peninsula. 197 sheets of specimens were presented by the Superintendent of the Royal Gardens, Calcutta, and various types were sent to the Director of Gardens for comparison. By the kindness of Mr. BARNARD, Deputy Conservator of Forests, I was able to send the Overseer to accompany him on a collecting trip to Gunong Kerbau, a mountain some 7,000 feet high on the borders of Kelantan. The herbarium specimens collected were poor owing to few things being in flower at the time, but a few interesting live plants were obtained.

The usual periodicals were received. Thanks are due to the Government of India for the presentation of Volume XI, Parts 1 and 2, of the "Annals of the Botanic Gardens, Calcutta." The following were also presented:—"Journal and Proceedings of the Asiatic Society of Bengal," Volume LXXIV, Parts 2 and 3: The "Kyoto Imperial University Calendar:" "Trees and Shrubs" by Professor SARGENT: and various Annual Reports of the Botanic Gardens and Forests.

Sale of Plants.

The nursery made last year has been useful to the extent of supplying 1,547 plants for sale. It is at present fully stocked with a mixed collection of plants useful for planting out and for sale.

Para Rubber.

The success of this marvellous product reached a height little dreamt of a few years ago, prices well over 9/- per pound being realized. The result has been one of eagerness to turn any piece of ground into a rubber plantation; and the number of these irregular plantations is surprising; especially is this so in Kedah, where many of the Estates formerly under tapioca are now exclusively or partly planted up with rubber. On the invitation of Mr. NATHAN, District Officer, Balik Pulau, I visited his District and gave a field lecture and demonstration on the best methods of tapping rubber trees. The many squatters who attended have more or less planted up their holdings with para rubber, and from the questions asked, and the keen interest they showed in what I said, proved how greatly they were interested in this cultivation. The old tree in the Gardens was tapped during the year and yielded 8 pounds and 4 ounces making the total yield, since the first tapping in 1885, 52 pounds and 6 ounces. A small parcel of rubber was sent home in October, but as the sales were unfavourable at the time, the Brokers held for the next sale, consequently the account sales will only appear this year, 1910. They further suggested keeping our supplies till they reached at least 2 cwt. I anticipate that during the next few months a sufficient sum will be realized to liquidate the loan advanced by the Treasury to purchase the Nursery site in 1906.

Governor's Hill Gardens.

These have been maintained in good order during the year, the very heavy rainfall has been against them. The hon'ble Resident Councillor presented 40 rose plants which I ordered for him from Messrs. CHATTERJEE of Calcutta, these have been planted out and should in time replace those that are old and worn out.

Coconut Trees Preservation.

I append returns showing that in Penang 331 notices were served calling on owners to destroy 480 dead coconut trees, 332 trunks, 12 heaps of manure and refuse. There were five cases of prosecution which resulted in small fines amounting to \$10. It is worthy of note that 60 of the 480 dead trees are supposed to have been killed by lightning.

In the Province the Inspector reports that the Districts of Simpang Ampat, Matang Tinggi, and Jungong were most attacked during the year. Malakoff Estate was badly attacked by the larvæ of a small moth. For a few months the trees presented the appearance of having been burnt. They eventually recovered and now appear little the worse for their attack. During the attack I twice visited the estate and suggested remedial measures. In the Province 303 notices were issued to destroy 749 dead trees, 1,077 trunks, six heaps of manure and rubbish. There were six prosecutions with small fines amounting to \$8.

W. FOX,

Superintendent of Forests and Gardens, Penang.

Expenditure of the Botanic Gardens, Penang, 1909.

Government Grant.	Estimated, 1909.	Expenditure.
	\$ c.	\$ c.
		Wages ... 4,032 08
		Tools and materials ... 468 62
		Manure and Cartage ... 70 25
		Flower pots ... 150 14
Maintenance of Waterfall		
Gardens ...	4,900 00	Freight ... 24 00
Extension ...	200 00	Plants ... 38 44
		Petty Expenses and
		Miscellaneous ... 94 73
		Superintendent of Immi-
		grants ... 200 00
		5,078 26
		Balance ... 21 74
		\$5,100 00
		Wages ... 1,142 44
		Tools and Materials ... 113 14
Upkeep of Ground's of Gov-		
ernor's Hill Bungalow ...	1,600 00	Flower pots ... 174 70
		Seeds ... 41 04
		Miscellaneous ... 37 00
		1,508 32
		Balance ... 91 68
		\$1,600 00
		Horse Allowance ... 300 00
Travelling and Personal		
Allowance ...	400 00	Field Allowance ... 48 97
		348 97
		Balance ... 51 03
		\$ 400 00
		Allowance to Inspector ... 369 23
Expenses of carrying out the		
Provision of the Coconut		
trees Preservation Ordi-		
nance ...	450 00	Destruction of dead coconut
		trees ... 4 00
		373 23
		Balance ... 76 77
		\$ 450 00
Purchase of Books and Perio-		
dicals ...	100 00	Purchase of Books and Perio-
		dicals ... 39 81
		Balance ... 60 19
		\$ 100 00

Revenue Collected and paid into the Treasury during the Year 1909.

					\$	c.
Sale of plants	...	...	...	...	551	58
Sale of Coconuts	...	...	...	...	2	50
Miscellaneous Receipts	...	...	...	...	32	67
					<hr/>	
					\$586 75	

No. of Notices issued during the year 1909.	No. of dead Coconut trees destroyed.	No. of Coconut trunks destroyed.	No. of heaps of Cattle dung destroyed.	No. of heaps of rubbish heaps destroyed.	Amount of fines recovered.		REMARKS.
					\$	c.	
Penang District 331	480	332	...	11	10	00	5 Prosecutions.
Prov. Wellesley.—							
Central District 148	510	561	...	2	...	...
Northern District 121	136	368	6	...	8	00	6 Prosecutions.
Southern District 34	103	148	...	...	...	...
Total ... 634	1,229	1,409	6	13	18	00	11 Prosecutions.

Return of Rainfall for the Criminal Prison, Fort Cornwallis, and Government Hill during the Year 1909.

MONTHS.			Prison.		Fort.		Government Hill.	
			Ins.	cts.	Ins.	cts.	Ins.	cts.
January	...	...	3	39	4	33	4	41
February	...	...	5	19	4	65	6	22
March	...	...	3	32	5	30	4	54
April	...	...	2	32	2	16	7	98
May	...	...	3	11	4	42	8	04
June	...	...	14	67	12	95	19	88
July	...	...	6	86	5	50	10	05
August	...	...	14	76	14	23	17	85
September	...	...	26	57	27	84	27	77
October	...	...	32	11	28	76	33	28
November	...	...	15	63	14	86	19	38
December	...	...	2	38	1	67	4	38
Total	...	...	130	36	126	67	163	78

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS
SINGAPORE,

FOR THE YEAR

1910

BY

H. N. RIDLEY, M.A., F.R.S., F.L.S.,

Director of Gardens, Straits Settlements.



PUBLISHED BY AUTHORITY.

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1911.

Annual Report of the Botanic Gardens, Singapore, for the Year 1910.

Staff.

There were considerable changes in the staff of the Gardens this year. Mr. T. W. MAIN left in May, and was succeeded by Mr. J. W. ANDERSON who arrived on July 29th. Mr. FOX retired from the service on pension in March after a service in the department of thirty-one years. Immediately on his retirement the Penang Botanical Gardens were put under the charge of MOHAMED HANIFF, the Overseer, and finally abolished in the middle of the year, the ground being presented to the Municipality for a water reservoir. The apprentice, PAUL, was dismissed and one MARIANI was taken on in his place. A Label Printer, DANIEL, was taken on at the end of the last year and has remained on till the present year. The Clerk of the Rubber Experiments, I. SANDOSUM, left in October and POONOSAMY replaced him in the Economic Gardens and a new Bill Collector, DURAISAMY, was taken on in place of the latter.

There was a great scarcity of labour in the early part of the year and only very inferior coolies could be obtained at any price; Javanese of any use were very difficult to procure, and recourse had to be had to Boyanese and Tamils. Towards the end of the year matters became better and a sufficient supply of labour, chiefly Tamil, was obtained. This shortage was due to the great demand for the rapidly increasing rubber estates in the vicinity.

In order to induce as far as might be the Tamils to settle down and stay in garden employ it was necessary to build a suitable set of lines for them. This was a wise step in the present state of the labour market. The Gardens have gradually become a dumping and training ground for Javanese. The younger ones came to learn Malay, the old and sick ones to earn a little and die. Whether they come as coolies with the intention of becoming gardeners or rubber tappers, they come merely for a training or to be able to say they have been employed in the garden so that they can easily find posts at a higher salary, when they are more or less efficient. This results in our getting only the rawest and often most useless material, who are trained here for the benefit of every part of the Peninsula except ourselves and these men when worth their salary leave for a billet on a rubber estate either of themselves or by the seductions of a crimp. We hope that the new Tamil cooly lines will form an inducement to these men to form a permanent settlement, but it should be noticed that their cost is a heavy one on the Gardens where it would be more desirable to spend all the hard earned balance in progressive work.

The better class of planters in the neighbourhood refused to take on men from the Gardens who had not received permission to leave, but natives and others were not so considerate. One Dutch crimp was found soliciting the men to run away. It is regrettable that there is no law capable of dealing with these nuisances.

There was comparatively little sickness among the coolies during the year but one elderly man died of phthisis and a child of about two years of age died of atrophy and weakness. Twins were born to a Malay in the lines, a very unusual circumstance, but only one of them survived its birth many days.

Visitors.

A very large number of botanists and agriculturists of note visited the Gardens during the year as well as very many planters from the Native States and elsewhere and the usual stream of tourists.

Among the best known visitors were the GRAND DUKE and DUCHESS of Brunswick; SULTAN OF LUBWA, Shan States; Dr. WILLIS (Ceylon); E. GEDGE; Prof. ROBERT WALLACE; Mr. STRICKLAND (Mysore); Dr. GUNNING (Leicestershire); G. P. WILDER (Honolulu); E. A. KORN (New York); A. S. HARDY (New York); I. E. FRASER (Sydney); E. DE KRUYFF (Department of Agriculture, Buitenzorg); A. W. PRAUTCH (Manilla); I. VAN BRERO (Batavia); H. E. WESTENDORP (Java); OTIS BARRETT (Washington); Baron C. DE S. LOHMAN (Inspector of Native Agriculture, N. Indies); Dr. SCHLECHTER (Kgl. Bot. Museum, Dahlem); M. C. COISPELLIER (French Indo-China); A. LEGRAND (Phuquoc); Mr. BEEBE; Dr. GEORGE KLEBS (Heidelberg); GEORGES VERNET; Capt. C. A. LITTLER (Commercial Agent for Tasmania); R. SPANGENBERG (German New Guinea); Prof. G. SENN (Basel); Dr. S. V. SIMON (Gottingen); Dr. OSKAR WALTHER and Dr. N. MAXIMOW (St. Petersburg); Dr. BARTHELS; M. E. M. LEPLAE (Brussels); Dr. HENKEL (Darmstadt); Dr. HAYATA; Y. KAGAMI (Director Horticultural College, Chibaken, Japan); KUWAGARO HAGA (Bureau of Production, Formosa); Dr. TSUKIDA (Tokio); H. IBARA (Osaka).

The band of the Middlesex Regiment played on numerous occasions by moonlight and the Fifes and Drums every Wednesday. These entertainments proved very popular.

There were many complaints about reckless driving of Motor Cars in the early part of the year, and one car containing a man and woman drove over one of the ducks belonging to the gardens lake and killed it. The culprits who were driving at a dangerous speed on seeing what they had done merely drove away faster and it was regrettable that they could not be detected. Steps, however, were taken by the police and several bad drivers were cautioned with the result that the nuisance much abated. There were no thefts of any importance.

Buildings, Etc.

The new bungalow for the Assistant Curator was built by the Public Works Department. The old watchmen's quarters was pulled down and new ones built on a more convenient site. A special vote was given for this. The cooly lines were repaired and re-atapped and two insanitary houses in the lines destroyed and rebuilt in better position. A new cooly lines for Tamils with a well and out-houses was built at a cost of 1,000 dollars from Garden funds. The floor of the rubber-curing house was laid down in cement, and a new packing shed built and the potting shed in the Economic Gardens was rebuilt. The Garden store house was repainted and whitewashed.

Telephonic communication has been established between the Botanic Gardens and the Economic Gardens, which has saved a great deal of waste of time in communication formerly done by messenger.

Beds and Borders.

Owing to the large demand for shrubs, etc., a small addition was made to the nursery, while new rose beds have also been made on ground adjacent to the nursery. This entailed a lot of work as a bamboo stump proved very difficult to extricate and ultimately two oxen with the help of a large gang of coolies were requisitioned to remove it.

The ground behind the Herbarium on which the old Aviary stood has also been attended to. A few of the large boughs overhanging the Herbarium were removed in order to keep the building drier, while the soil was well manured and suitable plants planted therein.

Tree cutting occupied a considerable amount of time, one in particular (*Adenanthera bicolor*) being very awkward to remove. The wood was extremely hard and the stump took fully three weeks to dig out and remove. The last of the old original clove trees on the band stand had to be removed, having succumbed to old age.

Throughout the year the troublesome waterweeds have had to be removed from the lake several times, while fresh *Nymphaeas* were planted round the margins to replace the ones which had become worn out.

A small jungle path was also made leading from the flower house by the back of the fernery and propagating houses, joining the older rockery at the entrance to the jungle.

The ground round the Assistant Curator's quarters was cleared of bracken and scrub, beds and borders being made and suitably planted.

New or Noteworthy Plants.

The following plants flowered and fruited in the Botanic Gardens for the first time :—

Malay Peninsula.

- Strobilanthes albostriata*.—Pahang.
Thysanotus siamensis, n. sp.—Setul.
Cladium glomeratum.—Singapore.
Fimbristylis longispica.—Setul.
Dendrobium serpens.—Perak.
Euphorbia synadenium, n. sp.—Penang.
Ceratostylis linearis, n. sp.—Penang.
Hoya lasiantha.—Perak.
Didymocarpus, n. sp.—Gunong Kerbau.
Ottelia alismoides.—Penang.
Gastrochilus acutus, n. sp.—Setul.

Malay Islands and Polynesia.

- Cœlogyne concinna*, n. sp.—Sumatra.
Dendrobium, n. sp. near *D. crumenatum*.—New Guinea.
Cyrtandra mammillata.—Borneo.
Saccolabium fragrantissimum, n. sp.—Borneo.
Dendrobium spectabile var.—Solomon Islands.
Eria ramulosa, n. sp.—Sumatra.
Kentia Woodfordi.—Solomon Islands.
Licuala grandis.—New Britain.
Acacia Auriculæformis.—Australia.
Dendrobium Donckærti.—Annam.
Primula gigantea.—Siberia.

India and Ceylon.

- Dendrobium moschatum*.—Assam.
Lagenandra toxicaria.—Ceylon.
Hibiscus cannabinus.

Africa.

- Apicra aspera*.
Ochna Kirkii.
Oberonia equitans.—Seychelles.
Kalanchoe Kirkii.

America.

- Solanum sisymbriifolium*.—Brazil.
Aechmæa Mariæ-Reginæ.
Muntingia calabura.—West Indies.
Oenothera Drummondii.—N. America.
Spathiphyllum longirostre.
Aristolochia fimbriata.
Catasctum, sp.
Læliocattleya La France.—(Hybrid).
Anthurium digitatum.
Lobelia syphilitica.
Tagetes signata var *pumila*.—Mexico.
Anemia rotundifolia.—(Produced spores)

Europe.

Silene penduliflora, compacta.

Alyssum maritimum.

Tanacetum vulgare.

Salvia glutinosa.

Plant and Seeds Sent Out.

Excluding Para rubber seeds, 211 packets of mixed seeds and 244 packets of palm seeds were distributed throughout the year. The recipients were :—The Botanic Gardens of Brussels, Berlin, British Guiana, Buitenzorg, Calcutta, Cambridge, Ceylon, Durban, Edinburgh, Formosa, Glasnevin, Hongkong, Kew, Manila, Nishigawara, Japan, Ogasawara, Japan, Saigon, Seychelles, Tonga, South Pacific, Uganda, Washington, Victoria, Department of Agriculture, Federated Malay States, Damman & Co., Dreer & Co., Philadelphia, and the Department of Agriculture, Mysore.

Plants were also supplied to Government House Domain, the Resident, Malacca, General Hospital, Military Gardens at Blakan Mati, A. J. SIMONS, Pontianak (in exchange), TAN BEN CHIANG (in exchange), and the Botanic Gardens of Kew and Mysore.

Herbarium.

The herbarium was largely increased by the collections made in the expeditions of the Director, and the Penang herbarium made by Mr. CURTIS was transferred to Singapore, and such plants as were required from it to complete the Singapore collection were incorporated therein. The following additions were made by exchange :—from Manila 59; Sarawak 8; from Calcutta chiefly Malayan plants of Wray and Kunstler 297; British Museum 10; from Mr. KLOSS, Malayan plants 21; and specimens were also received from Mr. BURN-MURDOCH, and MOHAMED HANIFF.

The following were the plants sent out : to Kew Gardens 675, British Museum 620, Calcutta 266, Berlin 193, Manila 99, Buitenzorg 14, to Mr. LILLY a number of mosses for identification.

The Singapore collection of *Laurineæ* and the *Loranthaceæ*, *Proteaceæ*, and *Thymeleaceæ* were sent on loan to Mr. GAMBLE for the materials for a Flora of the Malay Peninsula, a number of palms also to Dr. BECCARI for his work in the *Lepidocaryeæ*, and some ferns to Colonel BEDDOME to whom we are indebted for identification of the *Selaginellæ* and many ferns. Some injurious fungi attacking rubber trees were sent to Kew for investigation and one of them proved to be a new species of *Eutypa*, described as *Eutypa caulivora* by Mr. MASSEE in the "Kew Bulletin."

Several specimens of timbers of interest were added to the collection including those of Balau Betul, *Shorea materialis* Ridley and Balau Bukit, *Shorea collina* Ridley, described from specimens sent by Mr. A. M. BURN-MURDOCH.

Expeditions.

The Director visited Penang to take over the herbarium, library and such plants as were required for the Singapore Gardens in view of the abolition of those of Penang. After this he made an expedition to Kedah, Perlis and Setul. The object of this botanical expedition was to discover the boundary line between the Siamese flora and that of the Malay Peninsula. Large collections of herbarium specimens and living plants were made and brought to Singapore. These with the collections from Lankawi Islands made by Mr. CURTIS and the Director, the collections of Dr. KEITH in Bangtaphan and by other collectors in Trang, Tongka and such localities show that there is a complete change of flora at Alor Sta in Kedah and prove that at no distant date the Malay Peninsula south of Kedah peak was isolated from Tenasserim by a large tract of sea dotted about with islands of limestone rock, abounding in seabirds whose guano still remains in the caves of these islands. The flora of this new settled region was derived from Burmah and Siam, and contains hardly any purely Malay element. A full account of the expedition and the flora of this country is prepared for the press. Many thanks are due to Mr. W. G. MAXWELL and Mr. MEADOWS-FROST for great assistance to the Director in making these researches.

A short expedition was made earlier in the year to Kota Tinggi in Johore where aided by Mr. LEDOUX the Director obtained a large series of river bank plants, among which were a remarkable new *Utricularia* with extremely long stems and a new species of *Medinilla*. A number of interesting plants were also obtained in a

short stay at Kukub in Johore. The Director also visited Kuala Lumpur for a few days in December to consult with other members of the Committee as to steps to be taken for the International Rubber Exhibition to be held in London this year.

Publications, etc.

The "Bulletin" was published every month as usual, and there was an increased demand for it. Besides articles written for it by the Director there were published the following: Symbiosis of Ants and Plants, *Annals of Botany* ix p. 457, Note on the Flora of the N. W. States, Malay Peninsula (letter to Sir J. HOOKER) in "Kew Bulletin" 1910, 202. Poisonous principles of *Anacardiceæ*, *Pharm. Journ.*, vol. 84, 360. The account of the expedition to Temengoh was printed also in a volume of the Straits Branch of the Royal Asiatic Society which, however, was not actually published by the end of the year.

Figures and descriptions of three plants sent from the Botanic Gardens to Kew and flowered for the first time in Europe were published in the "Botanical Magazine;" they were *Gamogyne pulchra* n. sp. from Borneo, *Chirita rupestris* Ridl. from Lankawi and *Tristellateia Australasica* from Singapore. The fungus *Eutypa caulivora* was also figured and described from Singapore in the "Kew Bulletin." The usual course of lectures on Botany was given to the Medical students in the latter half of the year, and the Director also delivered a lecture on *Fomes* and *Diplodia* at the Agricultural Exhibition in August.

Agricultural Exhibition.

The last of the continuous series of Exhibitions of Agriculture and Horticulture was held in August. Till he resigned his post at the Gardens Mr. T. W. MAIN held the position of Honorary Secretary, and was then succeeded by Mr. RODESSE. The exhibition attracted a large number of foreign visitors as well as local residents, and was very successful. As usual the Garden staff acted as committee men and judges. Some remarkably fine samples of rubber prepared in the Botanic Gardens were shown and a collection of historical rubbers, showing the earliest samples of cultivated rubber ever made, from the Botanic Gardens collections attracted much attention. A very large number of palms, aroids, and other ornamental plants were also supplied by the Gardens for decoration.

At the suggestion of the Director a scheme for legislating against the spreading of the dangerous fungus *Diplodia rapax* in rubber estates was devised. The disease seems to be very prevalent in some parts of the Peninsula and might easily become extremely destructive.

Bhang.—As there is no known chemical test for Indian Hemp (Bhang or Ganja) which drug is prohibited in the Straits, the Director had to attend the courts on several occasions to identify the drug botanically.

ECONOMIC GARDENS.

The greater part of the work of these gardens was connected with the rubber industry. This work has increased to such dimensions that the whole of the staff of this garden was occupied nearly the whole time, and is not sufficiently large to make any great progress in other directions. The very large demand for rubber seed chiefly in the African Colonies entailed a vast amount of work in clearing under the trees, gathering, sorting, packing, parcelling and shipping. A large number of seed had to be supplied from other plantations, to the various Colonies, but for some unexplained reason these seeds did not possess the amount of germinative power of those of the Singapore Gardens which therefore are in high demand and still keep up the price of ten dollars a thousand.

A serious flood in January destroyed thirty Para rubber trees, mostly of large size, and swept away a large number of seed, causing a considerable loss to the garden. The plot referred to in last year's report as cleared for planting has been redug and well drained and planted with 414 rubber trees and 32 plants of *Raphia Ruffia* and 32 plants of *Raphia Hookeri* both palms of value as fibre plants. The rubber plot between Cluny and Bukit Timah Road has also been kept clean and the drains kept open. This plot has cost much labour and constant attention but as the rubber trees get up, the cost of weeding will be less.

Experimental tapping.—Tapping and curing by different methods was carried on throughout the year, and 2,429 lbs. of all grades of rubber was cured and mostly disposed of within the year. A fair proportion of the rubber was sold locally. A sample sold in London obtained a record price at that day sale. A large number of

samples of latex and rubber treated with formalin, etc., were submitted to various analysts for investigation and report.

The third Annual Report on the experiments of the previous year was published and has attracted much notice and been in steady demand by planters.

In the matter of plant disease, observations on *Phomes* which has been troublesome in the gardens, *Eutypa caulivora* and *Diplodia* and *Corticium* have been continued. A case of dieback of a young rubber tree due to *Eutypa* was observed in the gardens, the first definite evidence of its attack on living plants.

A large number of samples of trees attacked by various fungi were sent during the year to the Director for report. The fungi were chiefly *Diplodia* and *Corticium*, the former mostly from the Malay States, the latter from Borneo. *Corticium* seems to be more injurious in Java and Borneo than it is in the Federated Malay States.

Other plants.—The chief demand has been for shade and fruit trees and trees for windbelts, about 1,000 having been sent out. There has been an increasing demand for seed and plants of fruit trees but there has been some trouble in getting these at a reasonable rate owing to the poverty of the fruit crops for the last few years. The wild mania among natives in Singapore for planting rubber in every corner seems to have produced a great falling off in the supply of fruit, vegetables, poultry and even pigs, all being neglected or abolished to make way for Para rubber. It is highly desirable that the cultivation of fruit trees, neglected for some years, be encouraged.

There has been a considerable demand also for Leguminous cover crops, for green soiling and *Passiflora foetida* seed; also a small demand for Coca for hedging in estates and chocolate for New Guinea.

The largest demand for miscellaneous economic plants has been from Formosa where the Japanese have begun to start systematic tropical agriculture. Seeds of *Brucea sumatrana* have been sent from time to time to London for experiment and investigation.

Outside work.—A plot of ground at Goodwood Estate measuring seven-and-a-half acres was cleared, drained, fenced and planted with five hundred and seventy trees of Para rubber.

A plot of reclaimed land below Mount Zion also seven-and-a-half acres in extent was cleared and planted with 810 coconuts.

The rubber from the trees in Government House park was smoked and finished off and sold for the benefit of the Government House funds.

PARA RUBBER SEEDS AND PLANTS EXPORTED DURING 1910.

Seeds from the Botanic Garden trees	...	...	321,300
Seeds purchased elsewhere	..	...	1,005,000
		Total seeds	1,326,300

The following were the localities to which the seeds were sent :—

	Seeds.	Plants.
Singapore	15,500	35,029
Seremban	5,000	
Sarawak	2,000	
Kelantan	129,000	
Dutch Borneo	2,000	
Burma	5,000	
China	600	
Uganda	513,600	
Australia	400	
Sierra Leone	10,000	
Southern Nigeria	150,600	
British Guiana	84,600	
Papua	30,000	
British Honduras	1,800	
Liberia	273,000	6,000
C. Curtis (Barnstaple)	103,200	
	1,326,300	41,029

Coconut Trees Inspection.

Notices were served on ninety-seven persons to clear away stumps, dead trees and rubbish and 200 dead trees and 154 stumps and logs and 74 piles of rubbish likely to or containing beetles were destroyed.

The number of dead trees is small showing the effects of legislation in exterminating the red beetle. All or almost all the destruction of palms was caused by the black beetle; the red beetle is really nearly extinct, at least in Singapore. It will now be comparatively easy in future to guard the estates from any loss, though of course continued inspection will be necessary. The great and increasing importance of the coconut industry thoroughly justifies the care taken and the small expenditure employed in protecting the coconut trees by inspection.

Cost of Up-keep.

					\$
Inspector	...	...	...	...	324
Cooly	...	...	...	...	120
Transport	...	...	...	...	210
Total					<u>\$654</u>

REVENUE AND EXPENDITURE FOR THE YEAR 1910.

Up-keep of Botanic Gardens, Singapore.

REVENUE.

\$ c.

By balance in Bank on 1st January	...	...	1,960	29
Government Grant	...	...	7,950	00
By sale of plants and seeds	...	...	15,400	95
By sale of prepared rubber	...	...	7,551	07
Total ... \$32,862 31				

EXPENDITURE.

\$ c.

Salaries of Mandor, Coolies, etc.	...	...	11,344	12
Bills	...	...	15,878	68
Crown Agents for Tools, etc.	...	...	866	07
Balance remaining in Bank on 31st December	...	...	4,773	44
Total ... \$32,862 31				

BOTANIC GARDENS,
SINGAPORE, 6th February, 1911.

HENRY N. RIDLEY,
Director of Gardens, S. S.

STRAITS SETTLEMENTS.

ANNUAL REPORT

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FOR THE YEAR

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1912.

Annual Report of the Botanic Gardens, Singapore, for the Year 1911.

Staff.

The Director of the Botanical Gardens, Mr. H. N. RIDLEY, was on leave for six weeks in November and December, and after taking leave in the latter half of January, 1912, till the end of February, retires from the service after a period of over 23 years of service, *i.e.*, from November, 1888, till the present year.

The Curator, Mr. R. DERRY, was away on special duty in England for four months, from January to June, arranging for the patenting of his new rubber-smoking machine.

The apprentice, MARIANI, was dismissed and a new man DAVID was appointed in his place. An overseer for Tamils was also taken on by name of EDWARD. The Bill Collector, DURAISAMY, was discharged and RAPHAEL, the former Bill Collector, was reinstated. The Printer who had been employed in the Gardens for over thirty years, retired with a gratuity of three hundred dollars.

There was a great scarcity of labour throughout the year, and a rise of wages was found necessary. As mentioned in the report of the previous year, the class of coolies now procurable is very poor as the demand for labour on the estates is still very great.

During the first part of the year there was a good deal of malaria among the coolies, as there was all over Singapore, but the latter end of the year showed a marked improvement in health all round. Two young children died in the coolie lines. Owing to the unusual drought the water supply of the coolie lines failed at one time and water had to be brought to the coolie lines from outside by cart. The attention of the Public Works Department was called to this state of affairs, surveys and plans were made, and it was agreed by the Government that next year water should be laid on to the coolie lines and the quarters of the staff.

Weather.

The weather was unusually hot and dry during the months of February, March, April, June and July, entailing much extra work in watering the gardens and causing the death of a number of palms, which curiously in many cases only actually died after the rains had come.

On November 25th, there was a most unusual fall of ten inches of rain in six hours producing a heavy flood which upset a large number of trees in the Economic Gardens.

Visitors.

As usual, a large number of agriculturists and botanists visited the gardens, besides the ordinary travellers. Among the former were:—Mr. N. HOLTZ (Australia); Mr. T. KAWAKAMI (Formosa); M. LEMAIRE (Chef de Culture Congo Belge); Mr. SOMMER (New Guinea); M. BRENIER (Hanoi); M. KELWAY BAMBER (Ceylon); Mr. DIWEY (Washington); Prof. VAN ITERSOM (Delft, Holland); Mr. EVANS (Trinidad); Dr. BUCHER (Buea, German Cameroons); Dr. MILLSPAUGH (Department Botany Field Museum); M. VERNET and many others.

There were no complaints of damage done or prosecutions by visitors or others during the year.

The Five and Drums' Band of the East Kent Regiment played every Wednesday, in the afternoon, and was much appreciated. The full band played also by moonlight on two occasions.

Plants and Seeds received.

There were 843 plants and 550 packets of seeds received.

The contributors were as follows:—

TAN BEN CHIANG, Dr. Y. FUGINI (Formosa), B. KAWAKE, Messrs. J. CARTER & Co., (purchased), Commander E. DERIJ, Mr. NEUBRONNER, Yokohama Nursery, ALBERT SCHULIE (Hamburg), Mr. N. FISCHER, Mr. SEAH LEANG SEAH, M. HERB (Naples), and the Botanical Gardens of Jamaica, Edinburgh, British Guiana, Calcutta, La Mortala, Kew, Paris, British Honduras, Missouri, Sydney, Darwin, Natal, St. Petersburg, Trivandrum, Gold Coast and Saharanpur.

Plants and Seeds distributed throughout the Year.

Excluding Para rubber seeds, 160 packets of mixed seeds and 60 packets of palm seeds were distributed throughout the year.

The recipients were as follows:—

The Botanic Gardens of Adelaide, Bangalore, British Guiana, Brussels, (Eala), British Honduras, Baroda, Calcutta, Cambridge, Ceylon, Edinburgh, Formosa, Glasnevin, Jamaica, Kew, Lahore, Madras, Manila, Natal, Port Darwin, Seychelles, Sydney, New South Wales, Tonga (South Pacific), Washington, Uganda, (Entebbe), Christmas Island, Damman & Co., M. Herb & Co., F. HENKEL (California), and H. WRIGHT (London).

Plants were also supplied to Government House Domain, Raffles Girls' School, the Bureau of Agriculture, Manila, Military Gardens at Blakan Mati, Commodore DERY (in exchange), J. VAN BRERO (Samarang, in exchange), TAN BEN CHIANG (in exchange), Experimental Plantations, Taiping, and the Botanic Gardens of Kew, Port Darwin and Entebbe.

New Plants, flowered.

Among the interesting plants which flowered this year for the first time were:—

Decaschistia pulcherrima, n. sp.—Setul.

Bulbophyllum, sp.—Zamboanga.

Areca glandiformis.

Ardisia linearifolia, n. sp.—Perak.

Shorea bracteolata.—Malay Peninsula.

Careya arborea.—Indo-Chine.

Payena grandiflora.—Sumatra.

Chlorocodon Whitii.—Uganda.

Wallichia disticha.—Assam.

Pittosporum pentandrum.—Australia.

Cestrum salicifolium.—South America.

Bignonia hirtella.—South America.

Cocos campestris.—South America.

Acanthorhiza aculeata.—South America.

Cattleya, (*Brassio-cattleya*).—Minerva.

Dombeya, sp.

Buckinghamia celsissima.—Fruited.

Expeditions.

The Director visited Semangkoh Pass, Selangor, in the spring and obtained a large number of new plants and then made an expedition with Mr. H. C. ROBINSON and Dr. HANITSCH to the Pulau Adang group of islands off Lankawi, also in February in the *Seabelle*. A considerable collection of plants were made on these islands which had never before been botanically examined. In July, he visited with Mr. ROBINSON and Mr. KLOSS the mountain of Gunong Tahan, in Pahang, where six years previously Messrs. ROBINSON and WRAY had made an important collection of the flora showing the great interest attaching to this, our highest mountain. The ascent was made up the Tahan river and the whole expedition occupied seven weeks. A

very complete collection of the plants from the upper ranges was made, including one new genus of *Rutaceæ* and many new species. The flora showed a marked affinity with that of Mount Kinabulu in Borneo. Besides the dried plants a considerable number of living plants were brought down. Unfortunately the plant collector broke down with fever on reaching an altitude of 3,000 feet and had to be sent back, together with the Director's boy who was also too ill to proceed; but the loan of two Dyak collectors was obtained from Mr. ROBINSON and these proved indispensable.

The Director also visited several rubber estates in Johore to advise in cases of outbreak of disease.

Herbarium.

Besides the collection made in the expedition above mentioned, plants were received from MOHAMED ANIFF, 206 from Lankawi Island and Gunong Kerbau, from Berlin 320 specimens from German East Africa, from Calcutta 78, and from Manila 132 Philippine plants.

There were distributed to Kew 543 specimens, to the British Museum 355, to Calcutta 102, to Berlin 28, to Buitenzorg 57, to Dr. CHRIST (ferns 13), to the Rev. W. LILLY 37 mosses, and a collection of economic plants to the Tokio Botanic Gardens, Japan. Specimens were sent on loan for examination to Dr. BECCARI (palms), to Mr. BURKILL of Calcutta (*Dioscoreaceæ*) and some specimens to Buitenzorg.

Publications.

The "Agricultural Bulletin" was published regularly throughout the year, but owing to the uncertainty of the future after the retirement of the Director, it was found necessary to announce to the subscribers that it would cease at the end of the year.* This is regrettable as it had become a journal very much in demand and there was a continuous rise in the number of subscribers. A pamphlet on the history of the rise of the rubber industry in Malaya by the Director with additional statistics by Mr. LEWTON BRAIN was written and published at the Rubber Exhibition in London, and over five thousand copies were disposed of at the Exhibition. A paper on the flora of Lower Siam was published in a volume of the Straits Branch of the Royal Asiatic Society by the Director and papers on the flora of Pulau Adang and on the plants collected at Gunong Tahan, and one on new and rare plants of the Malayan region and on the plants collected by Mr. MOULTON at Batu Lawi in Borneo were completed and sent for printing. The Handbook on Tropical Agriculture dealing with spices was finally revised for publishing by Messrs. MACMILLAN. Figures and descriptions of three plants sent from the Botanic Gardens of Singapore and Penang and flowered for the first time in Europe, were published in "Botanical Magazine" during the year. They were:—*Pseuderanthemum Malaccense*, *Torenia atropurpurea*, Ridl., and *Cirrhopetalum longissimum*, Ridl.

A very fine climber which had been over twenty-five years in the plant house without name, and supposed to be *Chonemorpha macrophylla* was by Colonel PRAIN identified as one of the three species confused under this name, and was named *Ch. Rheedei* in a paper on the Chonemorphas published in the Bulletin. It was a native of Ceylon and Southern India and *Ch. penangensis* new species from Penang.

A new fungus discovered on fruits of pepper in Singapore and Borneo was sent to Kew and named *Colletotrichum necator* by Mr. MASSEE. The usual course of lectures on botany to the medical students could not be given this year owing to the absence of the Director on leave during the session.

Beds and Borders.

There has been an increasing demand for palms, flowering and ornamental shrubs throughout the year and consequently much time was occupied in lifting and packing those plants. A good supply of such plants is being maintained, but this has not been such an easy matter as in former years owing to the exceptional drought experienced.

One of the largest plants of *Brownea grandiceps* was killed by the persistent attacks of a shot-borer. Repeated attempts were made to save the tree by applications of coal-tar and a mixture of Jeyes fluid and soft soap consecutively but without avail. As all the roots and branches were burnt on the spot, no other tree in the immediate vicinity seems to have been attacked.

A large selection of Nymphaeas were obtained from Messrs. Dreer of Philadelphia and planted in the Garden Lake, from which a good display was obtained during the earlier months of the year. *Hydrocleis commersoni* or Water Poppy

* The "Bulletin" has been continued.

(previously thoroughly established in tubs) when placed in the open lake failed to grow and gradually disappeared. Another attempt will be made to establish this plant as its flowers are of exceptional beauty.

As the *Wormias* on the small island in the upper lake had grown to such an extent as to completely hide the curious aerial roots of *Pandanus Kaida*, it was found necessary to severely prune them. It is a debatable point whether all or at least a large part of the *Wormias* ought not to be removed from this part of the Garden as their roots spread rapidly and are gradually filling up the lake.

Advantage was taken of the prolonged drought to deepen the lower lake. Owing to its surroundings this lake has never been a great success and it is doubtful if the deepening carried out this year is of a permanent nature as the lake readily silts up again owing to the fact that one of the sewers from the main road empties a large part of its sand and rubbish into it. A large quantity of the mud and soil from the lake was used in strengthening the banks while the rest was stored for future use as it was found to be extremely rich in humus. This soil when mixed with a little sand has been largely used as a mulch and also as a compost for potpalms yielding excellent results.

Troublesome water weeds in the upper Garden lake were removed as in former years. As there are few suitable places for climbers to be seen to the best advantage, tall growing palms were utilised for this purpose by placing wirenetting round the stem to a height of 6 or 8 feet. A pleasing effect was thus obtained and during the coming year an endeavour will be made to utilise many more palms for this purpose.

The only remaining specimens of *Michelia Champaca* and *Manicaria saccifera* died and were removed.

Owing to the drought, the keeping of beds and borders bright with annuals, etc., was a matter of considerable difficulty. Dahlias were planted in beds this year for the first time and thoroughly justified themselves. Mention may also be made in this respect of *Lobelia syphilitica* which has proved a valuable acquisition.

Many plants were severely pruned during the year and most of the plants thus treated have improved greatly in appearance and floriferousness.

Economic Section.

The Curator was absent from January 31st to June 4th.

With the gradually increased area of previous years very little new ground has been opened and indeed, none could have been attempted except for extra labour paid from revenue by sales of rubber and rubber seeds. All the rubber ground lies on shallow soil with water in most parts at one foot below the surface and, as will be understood, in such situations weeds are prolific. Apart from other considerations it is necessary that this land be kept clean so as to clean-pick fallen rubber seeds. For this purpose—excepting two men in the nursery—the rest of the permanent band of 32 men were employed whenever available.

To keep the arboretum in fair order eight mowers were estimated as necessary, but for several months during the year the band was included with the rest of the employés on the rubber ground.

For collecting and packing rubber seeds; cultivation of other crops and maintenance of plots; general maintenance including repairs, damages—men have been drawn from maintenance work as the necessity occurred.

Despite the phenomenal drought which necessitated a small band of water carriers, considerable damage was done in January and December of the year under review by floods, through the loss of 60 Para rubber trees mostly large trees, in fact, some of the oldest, in low-lying parts of the garden.

New work includes clearing, draining and opening a small area (which it is intended to extend as labour permits) about two acres for the reception of various economic plants and fruit trees.

The rubber plot between Cluny and Bukit Timah Roads, containing over 500 trees planted 22 feet by 20 feet has been improved by opening cross drains between the rows of trees. Altogether 37 drains 2 feet by 1 foot six inches averaging 80 yards long were completed. The mere excavation of soil was a light task but the amount of hard wood cut through and removed represented occupation for a long time with a small band of men.

Owing to the paucity of fruit crops and consequent difficulty of obtaining seeds, the stock of fruit trees had become low but advantage had been taken of the 1911 abundant crop and all the fruit seedlings most usually in demand have been re-stocked.

Sale of Plants and Seeds.

The demand for various economic plants and seeds, including fruit trees, has been above the average but does not call for special remark under the heading of rubber. Altogether 837,599 Para seeds were distributed. Of these 372,500 were garden seeds and the remainder purchased or packed to order.

The seeds were despatched as follows:—

Government of Nigeria	...	...	...	355,000
British Guiana	...	...	...	60,000
British Honduras	...	...	...	1,800
Uganda	...	...	...	54,000
Papua	...	...	...	53,400
Sylhet	...	...	...	5,400
Mexico	...	...	...	2,400
Port Darwin	...	...	...	500
Saigon	...	...	...	10,200
Christmas Island	...	...	...	2,000
Kelantan	...	...	...	75,400
Destination unknown, Messrs. Boustead & Co.	...	...	...	100,000
C. Curtis	...	...	...	117,400
Total				837,500

Seeds consigned outside Malaya are packed in special tins locally made, each tin is capable of containing 600 seeds and with the packing material (padi arang) rice husk burnt to charcoal, comes under the 11 lb. limit of parcel postage. Seeds are placed in the tins, one by one, in 12 layers of 50 each and the rice charcoal is carefully filled in so that the 600 seeds, in effect, lie in compartments. The tins are then stitched in canvas coverings on which the address is hand-printed and declaration form affixed. In this way after an interval of ten weeks, good results have been obtained varying from 50 to 90 % of germination.

It will be, however, apparent that the work involved is considerable. Out of the seeds there were 1,055 parcels posted (mostly distributed *via* Brindisi) containing 603,000 seeds; 262 parcels or 157,000 seeds consigned by freight and 77,400 seeds packed in boxes for despatch by coasting steamers.

The sale of Para seedlings only reached 5,000 plants.

Rubber Experiments.

Tapping different group of trees was continued throughout the year except on very wet days, but owing to loss of trees through floods it may be necessary to re-arrange the groups on a new basis.

During the year 2,326 lbs. of sheet and biscuit were prepared, making a total of 3,230 lbs. all grades including scrap, old and new. Sales amounted to 2,415 lbs. realizing \$4,919.51. The rubber obtained is slightly in excess of previous years, but the value is slightly less due to the fall in price of raw rubber. Small quantities of rubber and some latex were as usual supplied for analytical purposes.

Goodwood Estate.

Considering the disadvantage of situation Para trees have grown well on Goodwood Estate and the seven-acre block was maintained in good order up to the end of October. Since then weeds are rife, but with fair weather this will be remedied. It should be remarked that, there is very little fall in the drains, and during very wet weather the flooded ground is unworkable.

Mount Zion Plantation.

A fire occurred on this coconut block and did slight damage. The trees destroyed have been replaced and all are now growing fairly well.

Penang Gardens.

The scheme for converting the Penang Gardens into a reservoir having fallen through, the Gardens have been, it is understood, re-transferred to the Government. It

will be remembered that the Gardens were handed over to the Municipality in 1910 immediately after the retirement of Mr. FOX. During the intervening period they were under the charge of MOHAMED ANIFF who maintained them in as good a condition as was possible under the circumstances. Their resumption by the Government as Botanical Gardens again will be received with much gratification by the numerous botanists and horticulturists in all parts of the world who constantly expressed their regret that these fine and celebrated gardens should be destroyed. No Curator has as yet been appointed to take charge.

Rubber Exhibition.

A series of specimens were prepared and sent from the Botanic Gardens to the Rubber Exhibition held in London in June.

They included specimens of the trunks of adult trees showing forms of tapping, samples of rubber and specimens showing leaves, flowers and fruit, and a case of historical specimens, illustrating the development of the industry, and comprising the first biscuits, and sheet, and the first tyres made from cultivated rubber. They proved a very attractive exhibit at the Show. The Director also attended meetings in Kuala Lumpur to arrange about the Planters' exhibits.

Bhang.

There were a number of cases of smuggling of Indian hemp into Singapore contrary to regulations, and as usual the Director attended Court on these occasions, to identify the drug.

Government House Domain.

The Government House grounds and Domain were again, in November, placed under the control of the Botanic Gardens Department and steps were taken to get them into good condition again as soon as possible. Upwards of two thousand ornamental plants and shrubs were supplied by the Botanic Gardens. An additional number of Para trees were planted by an extra gang of ten coolies employed for this purpose. Repairs were done to the bank of the croquet lawn damaged by the rain, and the gully which had become a jungle of weeds was cleaned in part, and planted with ornamental plants. A great deal of work will have to be done next year, before the grounds are in a fit condition.

Inspection of Coconut Trees.

Notices were served on 75 persons.

Two hundred and fifty-four trees, 95 stumps and 50 heaps of rubbish removed.

					\$ c.
Estimate	...	...	...	...	210 00
Transport	...	...	...	...	209 96
Balance	...	...	...	...	\$0 04

Revenue and Expenditure.

RECEIPTS.

					\$ c.
By balance in Bank	...	...	...	...	4,773 44
„ Government Grant	...	...	...	...	7,950 00
„ Sale of plants and seeds	...	...	...	...	8,613 77
„ Sale of prepared rubber	...	...	...	...	4,919 51
„ Bank Interest	...	...	...	...	66 53
Total	...	...	...	...	\$26,323 25

EXPENDITURE.

					\$ c.
Salaries	...	...	...	...	11,131 01
Bills	...	...	...	...	12,677 55
Balance in Bank on 31st December, 1911	2,514 69
					\$26,323 25

HENRY N. RIDLEY,
Director of Gardens, S. S.

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STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS,

SINGAPORE AND PENANG,

FOR THE YEAR

1912

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1913.

Annual Report of the Botanic Gardens, Singapore and Penang, for the Year 1912.

The body of this report relates to the Gardens in Singapore, the Waterfall Garden, Penang, being the subject of an Appendix.

Staff.

The Gardens Committee, Singapore, was strengthened in October by the addition of two members, Messrs. F. M. ELLIOT and H. W. FIRMSTONE.

The Committee therefore consists of:—

Chairman, the Director:

Members.

His Excellency Major-General	Mr. H. W. FIRMSTONE,
T. E. STEPHENSON, C. B.,	Mr. W. E. HOOPER,
The Hon'ble J. O. ANTHONISZ,	Mr. ST. V. B. DOWN,

Mr. F. M. ELLIOT.

The late Director, Mr. H. N. RIDLEY, went on leave on January 18th, and was retired on March 1st. Mr. DERRY, the Curator, Singapore, took over charge of the Gardens on January 18th from Mr. RIDLEY, and except for two periods remained in charge until October 17th, when Mr. I. H. BURKILL became Director of Gardens.

As overseer of the rubber tappers a man named EDWARDS was first appointed but he soon fell ill, and the present overseer NALLAMUTHU succeeded him.

The Public and the Gardens.

The public have freely enjoyed access to all parts of the Botanic and Economic Gardens through the year. Under the sanctioned and gazetted by-laws, the Gardens are regarded as closed after sunset (except on band nights when they are closed at 11 P.M.); but nightly two or three or more conveyances enter the Gardens even up to 2 A.M., and visitors sometimes walk in them. The public must recognize that they do this at their own risk; and that the management is not expected to light obstacles, etc., in the roads.

The band of the Buffs played in the Gardens on several occasions on full moon nights; and their Drums-and-fifes played on Wednesday evenings regularly in the children's hour.

Among the visitors were:—Their Highnesses Prince WILLIAM and Princess MARIE of Sweden; Major G. P. AHERN, Director of Forestry in the Philippine Islands; Professor PAUL J. BRÜHL of the Civil Engineering College, Calcutta; Messrs. H. J. ELWES, F.R.S., President of the Royal English Arboricultural Society, and LEON HAUTEFEUILLE of the Agricultural service of French Indo-China; Drs. JACQUES HUBER of the Botanic Gardens of Para, Brazil, and A. NATHANSON of Leipzig; Mr. J. PARKES, late of the Indian Cinchona Department; Mr. HENRY TRYON, Government Entomologist of Queensland and Dr. J. HARVEY JOHNSTON, forming the Queensland Prickly Pear Travelling Commission; Dr. F. C. VERMOESSEN, of the Belgian Agricultural Service; M. PHILIPPE DE VILMORIN, Vice-President of the Société Nationale d'Horticulture de France, and well known for his horticultural work.

Finance.

The balance carried forward from 1911 as recorded in the last report was \$2,514.69: having paid the labour bills of 1912 almost up to December 31st, the Committee carry forward to 1913 a balance of \$572.69. The outstanding debts to the Gardens on January 1st, 1912, were \$5,813.20, and on December 31st were \$2,832.85. The amount of unsold rubber in the Garden stores and in London on January 1st, 1912, was 1,078 lbs. and at the close of the year was 1,172 lbs. This means that there has been spent during the year about \$5,000 more than the revenue out of funds conserved in previous years; and that in 1913 the expenditure must be looked into very closely.

The Gardens received no special votes during the year 1912, and on the other hand had to give two hundred and more dollars' worth of labour towards keeping the rubber land on the Goodwood Estate tidy, a drain on resources which will not recur in 1913.

The revenue received by the Gardens by the sale of plants during the last five years has been:—

—	1908.	1909.	1910.	1911.	1912.
	\$	\$	\$	\$	\$
Ornamental Plants (approximate) ...	854	1,221	1,357	1,893	1,576
Rubber Seed ...	2,303	2,710	3,213	3,725	3,153
Rubber Seedlings ...	103	205	410	50	303
Other Economic Plants (approximate)	351	359	319	335	204
Rubber ...	6,405	3,843	7,551	4,920	4,520
Number of bills ...	138	180	248	257	315

The number of orders received steadily increases, as shown by the number of bills made out.

The Garden Catalogue.

Perhaps the greatest advance made during the year has been the publication of a Garden Catalogue compiled by Mr. J. W. ANDERSON. It is on sale, price \$1, at the Garden Office and by Messrs. KELLY & WALSH; and it is used as an exchange list. The number of species enumerated is 1,739. Horticultural journals reviewing the Catalogue comment on the rich collection of palms which indeed is a feature of the Gardens. The ten natural orders which are the largest in the list are:—

Orchids (Orchidaceæ) ...	...	...	276 species.
Ferns (Filices) ...	...	...	261 „
Palms (Palmæ) ...	...	...	245 „
Pea Order (Leguminosæ) ...	...	...	191 „
Arums (Araceæ) ...	...	...	170 „
Cinchona Order (Rubiaceæ) ...	...	...	96 „
Canna Order (Scitamineæ) ...	...	...	94 „
Spurge Order (Euphorbiaceæ) ...	...	...	90 „
Fig Order (Urticaceæ) ...	...	...	79 „
Grasses (Gramineæ) ...	...	...	71 „

but it is probable that the Orchids are much fewer than 276 owing to losses,

Acquisitions and Exchanges.

By exchange the Gardens received rather more than six hundred packets of seeds or living roots, and sent out almost the same number. The largest consignments were from the Botanic Gardens of Glasnevin, Paris, Lyons and Port Darwin. Messrs. DAMMANN & CO. and M. HERB, Seedsmen of Naples, also made a considerable number of exchanges. Whereas the Gardens sent out more living plants than packets of seeds, the Gardens received more packets of seeds than living plants; such an occurrence is a consequence of exchanges between countries replete with annuals and one such as this where annuals are in the minority. For gifts of seeds the Committee had to thank Mrs. LLOYD (Bangkok), Mrs. MILLS (Port Swettenham), Father GEX (Singapore), Messrs. EDWIN PHILIPS (Kuala Kangsar), ST. V. B. DOWN (Singapore) and A. RESASCO (Papua).

Among the new plants tried, *Asparagus falcatus* has done well and promises to be useful in the conservatory. *Dracæna hookeriana* which has long been in European Gardens, and probably before this in Singapore, is growing well. An *Agave heteracantha*, perhaps not the source of Tampico fibre—for their nomenclature is confused—has been raised easily from seed; but it is improbable that it will be an useful economic plant for the Straits. Some *Ipomœas* tried, if given a very great quantity of manure became strong; but it has not been possible to save their seed. *Oxyanthus natalensis* and *Dombeya natalensis* are both doing well as small plants; the former is described as a very handsome shrub growing generally under large trees; the leaves peculiarly large and shining and the corolla white. A species of *Hibiscus* (near *H. surattensis*) given to the Gardens by Mr. DOWN shows itself at home. In August the Assistant-Curator was sent to Sarawak whence he brought back a supply of living orchids, etc., and a collection of dried plants.

Beds and Borders, etc.

Beds and borders have been kept as gay as possible throughout the year under review, but to the uncertain weather must be attributed the grudging way in which plants flower. To avoid the irregularity of the beds, which is a consequence of this, many hitherto devoted to annuals and such plants, have been planted up with perennials, such as crotons, possessing variegated foliage.

Pruning and mulching with decayed leaves have been practised when necessary and well repaid the trouble and expense. Among the few plants marked by the abundance of their flowers were a *Phaleria* named *P. Blumei*, *Clerodendron macrosiphon*, *Mussaenda erythrophylla* and *Randia macrantha*.

The *Phaleria* has fruited plentifully during the year, and can be distributed widely as soon as sufficient stock has been raised. Beds of *Mussaenda erythrophylla* have been particularly attractive during the year owing no doubt to the plants having become established: many of these beds have been pruned with a marked improvement. *Clerodendron macrosiphon*, like *Mussaenda*, is found to require frequent pruning; when so treated it is nearly always in flower: a more extensive use of it will be made in the future. Now that *Randia macrantha* has become established, its suitability as a decorative shrub has become more noticeable; and as it delights in full sun or shade, it has proved extremely valuable. The *Canna* beds have been heavily manured on two occasions; but it will be necessary to obtain a new stock of these plants in the near future as that of the Garden is degenerating. A large part of the Fern-rockery had been somewhat unsightly owing to a fungus having killed many of the plants therein; and it was thought expedient to remove the old and infected soil, as applications of lime had proved unsatisfactory. This was carried out; and at the same time, taking advantage of the falling of some trees at the entrance to the rockery, a small extension was made which has added considerably to the attractiveness of this part of the Garden.

Nursery.

The nursery has been well stocked for distribution with young plants; but from the nursery it has been found expedient to pot up a supply of the newly rooted cuttings instead of lifting only when required for despatch: for the plants in pots after being kept for some little time, travel much better than lifted plants; and after adopting this plan not a single case of ordinary plants perishing in transit has been reported throughout the year. It is noticeable that those who buy plants from us are becoming much more particular; and the cases in which the choice is left to the Gardens are growing fewer. The stock of decorative palms for lending on special applications has greatly diminished, chiefly owing to the want of care and forethought of the participants of this great favour; and it will be necessary to curtail the favour considerably until the younger plants are of a sufficient size for the purpose.

Trees.

A wind storm in November destroyed the only specimen of *Gustavia speciosa* in the Garden. Old age has been telling on the avenue of Arengas by the Tyershall gate to such an extent that the greater part of the one side has had to be cut out and to be replanted. Many of the older *Dacrydiums* are slowly dying and a considerable number have been removed during the year. It is also noticeable that many of the older palms are showing the effects of the long droughts experienced in 1911 and 1912. Flooding by loosening the hold of the Para Rubber trees on the low part of the Economic Garden has caused some loss. On the other hand planting out has been carried on when possible; but it has been found that better results are obtained if the newer introductions are kept much longer in pots than has previously been done. This ensures a quicker and stronger growth when newly planted.

Plant-houses.

The usual show of Burmese *Dendrobiums* attracted a considerable number of visitors; but it is generally to be deplored that most of these plants with which at a cost the Gardens make the display, fail to establish themselves, slowly dying, so that regular and rather wasteful importations are necessary. *Thunias* flowered well and so did *Phaius Wallichii* which we had received from the Resident, Sarawak. A plant of *Cypripedium niveum* produced two large flowers on the one stalk—an unusual occurrence. A climber in the plant-house, hitherto undetermined, flowered during the year and was identified at Kew as *Schlegelia parasitica*; and though this plant rarely blooms until of a large size, the colouring and abundance of its flowers proved it to be an attractive addition to the Gardens' list of climbers.

The collection of Ferns has been augmented by a few new species from Japan which, despite coming from a colder climate, have adapted themselves fairly well to their new conditions. Further contributions have been promised.

The Lakes.

The big lake has been cleaned of weeds at intervals; and the water-lily collection was increased by a few of the newer varieties; but these did not establish themselves, so that the Gardens are left again with little more than *Nymphaea omarana* (*N. dentata* × *Sturtevantii*) and white *N. stellata*. In regard to cultivation in the lake the chief obstacle to success is silt and clay which rain storms wash into the water. Settling pits must be made both for the water coming from Tyershall and for the water from the Garden roads. The small lake to the north of the Gardens near Dalvey Road was confined by a raised bank and deepened, the mud removed being used for raising the low land behind the bank. When finances permit this rather unsightly corner of the Gardens will receive more attention.

Plants flowering.

The following plants have flowered in the Gardens for the first time:—*Aerides* sp., *Albertia magna*, E. Mey., *Bowiea volubilis*, Harv., *Cleome uniglandulosa*, Cav., *Crotalaria pumila*, Heyne, *Eupatorium Greggii*, A. Gray, *Kæmpferia* sp.: and the following both flowered and fruited:—*Borassus flabellifer*, Linn., *Jacquemontia violacea*, Choisy, and *Passiflora Watsoniana*, Mast.

Roads and Paths.

Half of the broad carriage roads in the Gardens were re-metalled at a cost of \$2,300. The side drains need repair and work on them was commenced in December.

To make the Garden jungle path more attractive for pedestrians a hedge is being raised between it and the chief of the leaf-mould collecting pits. The curtains of *Thunbergia laurifolia* along that path are magnificent; but few visitors see them.

The Economic Garden.

Demands for seed and seedlings of the Para Rubber tree made a large call upon the time of the Curator and his gardeners and labour force. 395,300 seeds were despatched during the year and 9,550 seedlings, being the whole of the seed available and nearly the whole of the seedlings. The Spring crop of seed almost failed in 1912:

and these seeds represent the Autumn crop. Of rubber 2,484 lbs. were made during the year. This figure may be compared usefully with past yields from the plots of rubber trees.

lbs.				lbs.			
—				—			
1906	...	...	1,110	1910	...	...	2,897
1907	...	...	2,467	1911	...	...	2,415
1908	...	...	1,894	1912	...	...	2,484
1909	...	...	1,257				

The trees were rested from tapping in May and June when the seed crop was being set. At that time the band of tappers was put on to general work. Loss of trees by wind has interfered with the tapping experiments, and the groups of trees taken as units are no longer exactly what they were.

A small consignment of Ipecacuanha has been received from India, and as soon as strong enough will be planted out for maintaining stock; another of *Piper cubeba* has been received from Buitenzorg and is being used for propagation. The collection of fruit and shade trees has been maintained. The following plants may be mentioned as having been in demand:—*Albizzia moluccana*, for shelter; *Eucalyptus* species, for drainage; *Clitoria cajanifolia*, for clothing slopes; *Panicum maximum* (Guinea grass) for fodder; *Elæis guineensis* (African Oil palm) and *Vanilla planifolia* (Vanilla). A small patch of Cotton has been planted out, and patches of various races of Pine-apple.

Buildings.

Of the buildings in the Gardens, those which are under the Public Works Department have only received petty repairs during the year. The Herbarium roof has commenced to leak very badly and alterations to it have been asked for. Of erections not made by the Public Works Department, the Plant House was repainted in March at a cost of \$300; and a small shed has been placed at the back of the carpenter's shed: its floor was laid in concrete and the roof is of corrugated iron on iron uprights. It is used for storing wardian cases, tubs, etc.

Investigations on the Malayan Flora.

The Assistant Curator's visit to Sarawak was the only expedition made during the year, and his collection has not been worked up yet. From the Government of India by gift were received for the Herbarium 50 determined mosses from the Abor Hills: from the University of Edinburgh 216 sheets of Indian and Chinese plants.

Specimens of Gymnospermæ, Balanophoraceæ, Rafflesiaceæ, and some allied small orders, were sent to Mr. J. S. GAMBLE for the completion of Sir GEORGE KING'S Materials for a Flora for the Malay Peninsula. A specimen of *Oryza Ridleyi* was lent to the Philippine Bureau of Science. During the year the Asiatic Society of Bengal published Parts 22 and 23 of the Materials, being pp. 1-278 of Volume LXXV of their journal. Most of these pages have come from Mr. GAMBLE'S pen; but the account of the Polygonaceæ is by Major A. T. GAGE.

Publications.

In consequence of want of staff the "Agricultural Bulletin" was suspended after five numbers had been issued. The compilation of a Garden Catalogue has been mentioned already.

Outside Charges and Duties.

The block of rubber trees on the Goodwood Estate was cleaned twice during the year: on the second occasion the cost of doing so fell upon the Gardens, as the grant, too small in 1912, had been exhausted. The block of coconuts near Mount Zion has had attention.

Government House grounds have been kept in order and various improvements commenced. It fell to all three Officers of the superior staff to be called to attend the Police Courts to identify Bhang. The coconut plantations on the Island of Singapore have been inspected regularly. Owners do not cut down trees without a notice, but when the notice has been served they have always done what was required. One hundred and three notices were served on 57 owners. Notices were served for the removal of 222 dead trees, and the clearing of rubbish in 36 cases.

New plantations have been made extending the area to be examined to the north-east, north, north-west and west of Singapore. The red beetle (*Rhynchophorus ferrugineus*) is now very rare; but the Rhinoceros beetle (*Oryctes rhinoceros*) is found without difficulty. The better to protect the coconut plantations of Singapore, legislation was enforced forbidding the import of such material as might bring *Aleyrodicus destructor* from the Philippine Islands.

Revenue and Expenditure, Botanic Gardens, Singapore, for the year 1912.

REVENUE.				\$	c.
By balance in Bank	...	...	...	2,514	69
„ Government Grant	...	...	...	7,950	00
„ Sale of plants, seeds and prepared rubber	...	...	...	14,064	96
„ Interest	...	...	...	59	33
Total				24,588	98
EXPENDITURE.				\$	c.
Salaries	...	...	...	10,324	23
Bills	...	...	...	12,528	17
Crown Agents for tools	...	...	...	1,163	89
Balance in the Bank on 31st December, 1912	...	...	...	572	69
Total				24,588	98

Botanical Gardens, Penang.

(Report by Mr. Mohammed Haniff.)

The Waterfall Botanical Gardens were taken over by the Government from the Municipality on the 21st February as from 1st January, 1912, being placed under the supervision of the Resident Councillor. Mr. MOHAMMED HANIFF was in charge throughout the year.

Theft.

There was one case of theft during the year, the clock in the Garden's Office being stolen by a Garden Watchman who was arrested, charged with house-breaking and theft and sentenced to 2 years' imprisonment on each count.

The Year's Work.

About 190 feet of 1 inch and 460 feet of $\frac{1}{2}$ inch piping were laid from the tank above the Fern-rockery for the supply of water to the New Orchid House and Fern-rockery.

A three-quarter span roofed frame 27' \times 3' 5" was constructed during the year. The materials used for this frame (granite slabs and common glass) were kindly given by the Municipal Engineer from the abandoned bungalows in the Catchment Area of the Waterfall Valley. The work of erection was carried out by the Garden's coolies. This frame has proved successful for the purpose of propagating and cultivating the plants brought down from the heights of the hills. There is a continuous flow of water from a $\frac{1}{2}$ inch pipe through the frame which reduces the temperature in it by 9° as compared with the temperature outside.

Two hundred and seventy-one feet of semicircular 6-inch glazed clay pipes were laid down to serve as side drains.

A large number of stones found protruding above the lawns and near the edges of the drains, were removed and the lawns re-levelled.

Upkeep and Buildings.

Five of the plant-houses were entirely re-roofed with attaps and bertam coverings.

The flower beds and the lily pond were well manured: and a fine display of flowers was the result. The water lilies flowered very abundantly and were very attractive.

The laying of the 18-inch pipes across the road above the office in the year 1910 to prevent sand being washed down into the lily pond during the wet weather has proved effective.

The most attractive feature of the Gardens during the year was the Orchid House staged with a large number of Orchids in flower, including Cattleyas, Cœlogynes, Vandas, Calanthes, Cypripediums, Habenarias, Phalænopsis, Oncidiums, Dendrobiums, Ærides, etc.

The annual flowering plants grown in pots such as Salvia, Petunias, Zinnias, Balsam, Phlox, are now grown in the more open spaces near the New Orchid House. They grow very much better and are hardier when raised in that new space.

Collecting expedition.

During the year the Overseer visited the Kedah Peak and Setol and obtained a large collection of Orchids, etc., for cultivation in the Gardens.

Exchanges, etc.

Plants and seeds were received from Messrs. D. LOGAN, Orchids and Palms (Penang), R. HOFFMANN, Caladium Bulbs (England), Hon'ble W. C. MICHELL, Orchids from Java, E. H. ANDRUSSE, Orchids from Java, JAMES VEITCH, Seeds (England), P. WILDER, Hibiscus (Honolulu).

Plants were supplied to M. A. GESSELEIRE, Director of Agriculture, Belgium Congo (10 wardian cases containing 346 Economic plants and 110 Coconuts); the Governor's Hill Gardens (79 ornamental plants and 36 packets seeds) and to Christmas Island (ornamental shade trees).

Para Rubber.

Some 121½ lbs. of dry rubber were collected from trees in the Gardens during the year, including 3 lbs. of dry rubber from the trees at the Residency. The single 27 years old Para Rubber tree which has been tapped continually since 1895, yielded 13½ lbs. of dry rubber during the year, making a total of 85 lbs. ⅜ oz. during the last 17 years. The weight of dry rubber of each year was as follows:—

		lbs.	oz.			lbs.	oz.
1896	...	Not recorded.		<i>Brought forward</i>	..	25	11 $\frac{5}{8}$
1897	...	1	0	1905	...	4	12 $\frac{1}{4}$
1898	...	3	0	1906	...	4	4 $\frac{1}{2}$
1899	...	5	12	1907	...	2	0
1900	...	3	12	1908	...	3	8
1901	...	2	2 $\frac{3}{8}$	1909	...	8	4
1902	...	2	13 $\frac{1}{4}$	1910	...	10	0
1903	...	3	6	1911	...	13	0
1904	...	3	14	1912	...	13	8
<i>Carried forward</i>	...	25	11 $\frac{5}{8}$	<i>Total</i>	...	85	0 $\frac{3}{8}$

Governor's Hill Gardens.

Mr. FERNANDO, who was in charge of the Gardens, maintained the ground and the plants in an efficient condition. All the plants in pots were repotted early during the year.

A collection of 31 varieties of new Roses was planted and is doing well.

The gardeners and the coolies from Waterfall Gardens at the request of the Resident Councillor were employed on several occasions repotting the plants.

Expenditure on the Botanic Gardens, Penang.

Waterfall Gardens :—

			\$	c.
Government Grant	...	...	4,500	00

EXPENDITURE.

			\$	c.
Salaries	...	...	3,787	32
Bills	...	...	701	20
Balance in Treasury	11	48
			—————	4,500 00

Governor's Hill Gardens :—

Government Grant	1,860	00
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EXPENDITURE.

			\$	c.
Salaries	1,742	32
Bills	116	99
Balance in Treasury	0	69
			—————	1,860 00

REVENUE.

By sale of plants	...	...	757	85
Miscellaneous receipts	...	...	28	74
			—————	\$786 59
			—————	

I. HENRY BURKILL,
Director of Gardens, S. S.

11th March, 1913.

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS,
SINGAPORE AND PENANG,

FOR THE YEAR

1913

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1914.

Annual Report of the Botanic Gardens, Singapore and Penang, for the Year 1913.

Staff.

The Committee of Management for the Gardens, Singapore, through 1913 consisted of His Excellency Major-General T. E. STEPHENSON, C. B., the Hon'ble J. O. ANTHONISZ, C. M. G., Messrs. H. W. FIRMSTONE, W. E. HOOPER, ST. V. B. DOWN, F. M. ELLIOT and the Director of Gardens. Throughout the year Mr. I. H. BURKILL, Director, was at his post, Mr. J. W. ANDERSON, Assistant Curator, Singapore, at his (except during two brief intervals), and Mr. MAHOMED HANIFF, Overseer, Penang, at his.

A new post—that of record-keeper—was made for the Penang Gardens, and filled, on July 1st, by the appointment of Mr. MAHOMED ISMAIL BIN ALI MERICAN. The duties of the post are in a small measure clerical, and in a larger measure connected with the labelling of the plants in cultivation.

There were during the year more interruptions of services than usual, four out of the six of moment being connected with ill-health. Mr. R. DERRY, the Curator, left for England on May 16th, on long leave. Mr. B. K. SAHIB, Foreman-Gardener in the Botanic Gardens, resigned after a service of fourteen years. Six months' leave to India was granted to the Gardens' clerk with effect from August 1st. The head watchman, Singapore, being unfit for his duties and at his age limit, left. Mr. MAHAMOOD BIN MUSA, Sub-overseer at Penang, after six years' service resigned to take up a post in Kedah. The Foreman-Gardener, Government House Domain, was granted leave out of the Colony for 25 days.

The Curator's work mainly fell on the Director, as his post could not be filled. Mr. KASTAWI BIN JALIL, Overseer in the Botanic Gardens, succeeded Mr. SAHIB; and the overseer of rubber-tappers succeeded Mr. KASTAWI. An untrained man was found for the post of sub-overseer, Penang. The clerical work in Singapore was done in August by a clerk lent from the Secretariat, and afterwards by the Inspector of Coconut Trees and a Herbarium subordinate jointly. Both arrangements proved unsatisfactory; the first because young clerks cannot be got to set up house in the allotted quarters and cannot keep office hours when living with their parents at a distance: the second because neither of the two named has the training of a clerk.

There was discontent in Singapore during the first part of the year in the labour force on account of the higher wages which could be obtained on rubber estates; it ended in the departure for Malacca of the greater part of the Javanese coolies and a strike among the Tamils on the Government House Domain. Soon after this the Malacca planters reduced wages, and there was no further trouble: but the Gardens had lost the trained men.

There were two deaths in the coolie lines, Singapore; one of an elderly man after an illness of three weeks; the other of an infant. Neither occurrence reflected on the healthiness of the lines.

Finance.

The amount budgetted in the Colonial Estimates for 1913 for the whole department exclusive of items borne on the vote of the Public Works Department, was \$43,365 being:—Central Staff, \$14,943; Penang Staff, \$1,968; Government House Domain Staff, \$780; Singapore Coconut Inspection, \$690; Malacca Coconut Inspection, \$612; Maintenance, etc., Singapore, \$12,536 (\$7,950 under the Gardens Committee); Maintenance of Government House Grounds, \$6,440; Maintenance, Penang, \$4,500; and Maintenance of the Rubber ground on the

Goodwood Estate, \$900. To this was added towards the end of the year \$460 towards the maintenance of the Gardens in Penang, as the allowance had proved inadequate, and at the same time \$1,500 was voted for the suppression of an outbreak in Singapore of the coconut pest, *Brachartona catoxantha*. When the year closed, there was a saving on the Goodwood Estate vote of \$246, and the grant against the coconut pest was not expended. Revenue amounting to \$469.15 was made by the Penang Gardens.

In accordance with the policy already laid down, the research work of the department and plant-dissemination in the country were as much as possible concentrated on Singapore, the functions of the Penang Gardens being pre-eminently those of a park; but by reason of the difference of climate, for raising certain stock for sale Penang is better than Singapore, and its services in this line must be continued. The spending of the grants being guided by these principles, changes are being introduced into the accounts in Singapore such as will make it possible to state what portion of any grant is expended for research, what part for the pleasure of the public, and at the same time to insure that the receipts by sales meet the costs of raising the stock. Rubber-tapping experiments in the Penang Gardens are being stopped: they added to the work of the Overseer, without latterly bringing to Government any more than they cost the Gardens.

At the commencement of 1913, the Gardens Committee, Singapore, based its estimates on the expectation of a revenue from all sources of \$22,522, but the actual fell short of this by \$2,818, in consequence of the low price of rubber and of a very small crop of rubber seed. The revenue from rubber was only \$2,661 and that from rubber seed \$1,647. Expenditure though estimated for at a rate much reduced on that of 1912, when it had been \$24,016, could not be kept below the income, so that the Committee commences the year 1914 with assets lower by \$710 than they were on January 1st, 1913.

	January 1st, 1913.	January 1st, 1914.
	\$ c.	\$ c.
In the Bank and in hand ...	672 69	3,123 41
Outstanding debts to Gardens ...	2,832 85	426 25
Value of rubber in hand ...	1,379 28	625 01
Total ...	<u>\$4,884 82</u>	<u>\$4,174 67</u>

A few figures are worth recording as showing how the Supplementary vote for the Waterfall Gardens was rendered necessary by the rise of wages, no increase of staff having occurred. These figures are as follows:—(i) from 1891 to 1901 the vote for maintenance was \$4,500 and the labour force absorbed 68 to 75 per cent of it: (ii) from 1902 to 1904 the vote was \$4,960 and the labour force absorbed 64 per cent: (iii) from 1905 to 1909 the vote was \$4,600, and over the five years the labour force absorbed increasing percentages from 76 to 88: (iv) after 1910 and 1911 when the Gardens were under the Municipality, the vote was fixed at \$4,500, but before the middle of 1913 was reached the proportional expenditure on labour and other things indicated that the former would absorb nearly 90 per cent, and that there were funds for the purchase neither of manure, nor of flower-seeds, nor of plant-pots. It is satisfactory that with the raising of the vote these essentials can be bought.

Towards the close of the year funds were asked for road-repairing, for the re-building of the larger kiosk and for the improvement of the Cluny Lake in the Singapore Gardens, and also for extensive lawn-improvements, new quarters and coolie lines in Penang, which have been voted in the 1914 budget.

Buildings.

The Gardens' Office, Herbarium and Curator's quarters, Singapore, have been repaired thoroughly by the Public Works Department; and so also has the Gardens' office in Penang. All were greatly in need of attention, the first three particularly from the extent to which decay had gone in their roofs, the latter from the state of the woodwork of its windows and doors. It will be remembered that the Gardens' clock was stolen in 1912 through a window that would not hold together.

The opportunity of having the roofs in Singapore untiled was taken for the felling of overhanging trees. A large *Ficus Benjamina* which caused the office to get little sun was removed, and three large trees were cut away from the west side of the herbarium. Much good has been done by this and by the repairs: the books in the

office have not gone so mouldy in 1913 as they did in 1912, and the herbarium appears drier. Nevertheless many of the cabinets holding the collections are falling to pieces by reason of the rusting of the nails in them, and the situation is not satisfactory.

Petty repairs have been done by the Public Works Department to the large plant-house and to the Gardens' store, Singapore.

The Gardens' Committee has re-attapped several sheds and small buildings, including the watchmen's quarters, the plant-house annex and part of the Javanese coolie lines: the rubber store and store-keeper's quarters have been altered slightly.

The Municipal Commissioners were permitted to lay gas-mains through the Gardens, Singapore; and in return they laid a water pipe to the Tamil coolie lines.

Records and Investigations.

The Director visited Penang on three occasions and once Malacca, Kuala Kangsar, Port Swettenham, Kuala Lumpur and the Kukob district of Johore: on these occasions a little collecting was done. The Overseer, Penang, visited Karangan in Kedah to collect living plants, chiefly the palm *Teysmannia altifrons* of which a satisfactory supply was obtained. The late Mr. A. M. BURN-MURDOCH collected for the Gardens along the Pahang river from Temerloh to the sea. Dr. J. D. GIMLETTE, Mr. H. B. MARSHALL and Mr. J. C. MOULTON have presented a few specimens from Kelantan, Brunei and Sarawak respectively. From the Royal Gardens, Kew, some Keeling Islands plants have been received. The Philippine Bureau of Science has given some specimens; and so also have Professor D. H. CAMPBELL and the Royal Botanic Gardens, Calcutta. The Philippine Bureau of Agriculture has given a number of photographs of plants.

Mr. OAKES AMES has supplied 75 sheets of Philippine orchids by way of an exchange.

Specimens of the higher plants to the extent of 104 numbers were sent to the Royal Botanic Gardens, Calcutta, and of fungi to the extent of 195 to the Royal Gardens, Kew. These fungi are chiefly the larger species found in the Singapore Gardens, and will be named by the staff at Kew: accompanying the specimens were 164 coloured drawings prepared by Mrs. BURKILL, which will be returned and added to the Singapore collections, where are duplicates of all the specimens. Some specimens of Myxomycetes have been sent to Miss G. LISTER, and kindly named by her.

To Major A. T. GAGE, Director of the Botanic Survey of India, the whole of the collection of Malayan Euphorbiaceæ was sent for the preparation of an account of the order in Sir GEORGE KING'S Materials for a Flora of the Malayan Peninsula. To Professor HUBERT WINKLER the whole collection of the Sterculiaceæ was sent for the preparation of a monograph in Professor ENGLER'S Pflanzenreich. To Professor O. BECCARI at Florence specimens of *Pinanga* and allied palms were lent and have been returned with his valuable identifications.

Among the visitors to the Gardens for scientific or economic work have been:— Professor D. H. CAMPBELL of the Leland Stanford Junior University, California; Professor K. ONO of Peking; Mr. J. F. C. ROCK of the College of Science, Honolulu; Drs. H. KÖNIG from the University of Kiel and DOPOSCHEG-UHLAR from the University of Munich; Dr. J. D. GIMLETTE of Kelantan; Messrs. LEWTON-BRAIN from Kuala Lumpur and J. C. MOULTON from Sarawak; Mr. P. DROUSIE, Director of Agriculture in the Belgian Congo; Drs. P. J. S. CRAMER and A. A. L. RUTGERS of the Department of Agriculture in the Netherlands Indies; Mr. H. M. CHIBBER, Assistant Professor of Botany, Poona; and Dr. HING KWAI FUNG of the Department of Agriculture, Peking.

For the recording of the work of the department and to bring it to notice, the publication of a Bulletin was recommenced. It is called the "Gardens' Bulletin"; and the five issues made in 1912 under the title of the "Agricultural Bulletin of the Straits Settlements" have been absorbed into it.

All the specimens of the timber collection have been numbered and a catalogue of them is being made. The numbers have been punched into the wood, so that nothing is likely to remove them: in the catalogue is being recorded all that can be read now on the delapidated labels. Unfortunately during 1913 want of staff impeded this necessary work.

The books in the library have been re-arranged; and pigeon-hole almirahs with expanded metal doors have been made for the unbound parts, of which there is a very great but unfortunately imperfect accumulation. Rats, which it is impossible to keep out

of the office building have done some damage to unbound volumes—wherefore the expanded metal doors; and as newly bound books receive a brushing over with corrosive sublimate and then a coat of varnish it is hoped to restrict their depredations. A slip catalogue of the books will be made as soon as possible: but because in the making of it missing parts may be revealed, action towards completing the series of journals taken-in has been deferred.

The gift of books and papers by the following is acknowledged:—Messrs. H. N. RIDLEY, J. S. GAMBLE, FELICIEN MICHOTTE, J. H. MAIDEN, SANDER & SONS, and His Belgian Majesty's Consul in Singapore. Many papers have been received through the editor of the "Gardens' Bulletin" by way of exchange.

The office records have been arranged and the administrative papers made up into files by subjects. Further arranging or destroying of accumulated letters regarding plants is yet to be done.

The despatches of letters during 1913 were 2,393 and the receipts 2,225.

During the year, the Potash Syndicate through Messrs. Behn, Meyer & Co., approached the Gardens with the offer of manures, if an experiment could be done with them, which offer was gladly accepted; and the five and nine-year old rubber trees in the Economic Garden were treated in different ways. The results will be made public in the "Gardens' Bulletin."

One-twentieth of an acre was given up to an experiment with *Hedychium coronarium*: but it showed no such vigour as would make it worth growing for paper stuff.

A small plot of *Dioscorea aculeata* was grown and gave sufficient promise for the experiment to be continued.

The rubber-tapping has been continued on the old lines as a matter of temporary convenience, because the whole records had to be gone through in order to ascertain whether any value remained in the complicated arrangement which the first experiments rendered necessary. Believing now that there is none, a complete break will be made; and the first work will be the selection of the best seed parents.

The continuous tapping of the large tree in the Penang Gardens has been brought to a conclusion.

Beyond the limits of the Gardens, experiments have been made on the removal of coconut stumps and trunks by means of explosives.

The authority of the department was twice called in to certify plants for export free from dangerous disease: and on sixteen occasions evidence was given in bhanga cases in the Police Courts.

A few observations on orchids were published in the "Gardens' Bulletin." In the same place is now recorded the rainfall in both Gardens: the Singapore records are read in a gauge placed near the Director's house; while the Penang records are those read by the Municipality at the head of the Waterfall Gardens, which are kindly placed at the disposal of the department.

Botanic Garden, Singapore.

At the full-moon of almost every month throughout the year there has been a concert in the Gardens. In January the band of the East Kent Regiment played; subsequently that of the King's Own Yorkshire Light Infantry played by the kind permission of Lieut.-Colonel A. G. MARRABLE and the officers of the Regiment. The bugles of the same Regiment frequently played for the children in the afternoon.

Towards the beginning of the year the Gardens Committee had an arrangement whereby the band of the 3rd Brahmans was to play in the Gardens on the first Monday of the month at 5 P. M.: but almost immediately private individuals came forward with funds for employing a band on every Monday afternoon; and after that the bands of the two regiments more or less took turns, assisted twice by the Associated Scottish Pipers of Malaya, and replaced twice by other bands.

The Chief Police Officer, Singapore, framed excellent rules for the ordering of traffic on these occasions, which were enforced. For the purpose of the rules it was necessary to name and label some of the roads in the Gardens, and directive names were selected such as "Main Gate Road," "Office Gate Road," "Ring Road," which help the visitor in finding his way: where these could not be used the names were taken from the nature of the vegetation along the roads such as "Liane Road" and "Maranta Avenue."

Since the coming of the motor car, the wear and tear on the Gardens' roads has increased considerably, and also their use at night. No record is kept of day visitors;

and the night record is certainly imperfect: but exclusive of band nights, 1,278 motors and 178 carriages are known to have been driven over the Gardens' roads during 1913 after dark, 946 motors and 48 carriages merely passing through, 332 motors and 130 carriages halting at the bandstand. The cars and carriages bring in the first place Europeans and in the second Chinese. This visiting of the Gardens after dark by carriage-folk is not unsatisfactory, for twice only have the visitors done anything objectionable; but the roads were never intended to be used as thoroughfares as frequently seems to be the case.

The attendance on band nights seems to approach 1,000.

Several petty thefts of flowers by otherwise respectable persons occurred, and one theft of some edible roots which were under experimental cultivation.

A list of motor cars observed to be travelling unreasonably fast is kept. The pace in the Gardens should be much less than on the roads outside.

Mention has been made, above, of the labour trouble in the middle of the year: when it occurred it was impossible for a short time to keep the lawns tidy, for new men had to be obtained and then taught to use a scythe.

Half of the rain gutters edging the roads have been repaired. The head of the lake has been partially cleaned, and a series of five catch pits placed at it, the last of which is a corner of the lake itself: it is believed that these are doing good work. At the bandstand several large beds have been grassed over, as it was impossible to keep them tidy. The two largest beds, which carried shrubs, have been heavily manured and will be used for Cannas. At the Director's house the secondary jungle has been driven back and a rather clear place prepared with high benches for raising annuals. Similar high benches have been placed at the Assistant Curator's house for the same purpose. From these benches as well as from the nursery the plant-house annex is now kept gay with flowers. For the improvement of the nursery some large overshadowing trees have been removed. This partly, and partly the change of staff, have led to an improvement in the condition of the orchids, whose habitat is rarely where the air stagnates, but near the breezy upper surface of a forest. Adjoining the nursery a Begonia Garden has been made. The planting of Cannas for effect near the lake has been commenced. In the hope of ultimately making a named collection of the smaller local orchids a double row of Plumerias has been planted along one edge of the Palmetum; and when the branches are large enough whatever can be got to grow on them will be planted in masses. The idea of using Plumeria has been taken from the famous gardens at Buitenzorg.

As it has been noticed that the fern *Gleichenia* is spreading in the Gardens' jungle and that natural regeneration of trees is at a complete standstill where it rules, steps are being taken to repress the fern, and by a slight liming to get the earth back from an acid condition which is connected with the change.

The lower nursery has been well stocked with shrubs for sale. To regulate the sales a price list has been published in the "Gardens' Bulletin" which serves for Penang as well as for Singapore: but the larger stock of plants for sale is kept at Singapore.

Tree-planting.—A tree of *Eucalyptus pulverulenta* has been planted out at the bandstand. A few Caryota palms have been removed from the neighbourhood of the office gate and *Oreodoxa regia* substituted. *Licuala grandis* has been planted out by the office gate road, *Lodoicea seychellarum* by the lake side, *Petræa erecta* and *Sapindus Mukorossi* near the Herbarium, *Aleurites cordata* (seed obtained from a tree in the Government House Domain) near the bandstand.

Araucaria Cookii, *A. Bidwillii* and *A. excelsa* have been planted to form an avenue near the main gate.

The tree of *Gustavia speciosa* which was destroyed to the ground by a storm in 1912, has come up again from the roots.

Acquisitions and exchanges.—The water lilies obtained from Mr. DREER, Philadelphia, by exchange have been a great success, and so has one variety (*N. marliacea*, var., *chromatella*) obtained from the Sydney Botanic Garden. Large Chinese pottery baths, well filled with good earth were placed for them in the bed of the lake; and to this treatment they have responded. A large collection of named varieties of Dahlias from Messrs. DOBBIE & Co., Edinburgh, has given much satisfaction. Many new races of Canna have been obtained from Messrs. DAMMANN & Co, Naples; but it is not time yet to report on them: one Canna, "Little Gem," obtained by exchange from Mr. C. CURTIS, lately Superintendent of the Penang Gardens, has done well. *Pennisetum Ruppellii*, *Browallia Czerwiakowski* and *B. Ræzli*, obtained from Messrs. SCHENKEL of Hamburg and HERB of Naples have proved most useful and ornamental. Mr. J. C. HARVEY, a valued correspondent, has

sent to the Gardens from Mexico, during 1913, *Dioon spinulosum*, *Nolina recurvata* (*Beaucarnea recurvata*) two Amaryllids and *Randia Mussænda*—all successes. Mr. KAWATE, Director of the Experimental Garden in the Ogasawara Islands, has sent a very useful collection of ferns. From Mr. L. G. REGNARD in Mauritius have been received *Acanthophænix nobilis*, *Grevillea Hilliana* and *Parkia timoriana* (*Inga timoriana*), and from the Botanic Gardens, Cambridge, *Buddleia variabilis* and *Melaleuca hypericifolia*—all successes. Mr. REGNARD has sent seeds also of many other palms; but it is not known yet how many will grow well. A *Cassia* of considerable beauty has been obtained from the Residency, Pahang, under the name of "Cassia blanca," and several desiderata from the Superintendent of the Government Gardens, Thaiping; and from the Royal Gardens, Kew, two wardian cases have been received containing many desiderata, chiefly succulents.

For the gift of seeds of local origin the Gardens are indebted to Messrs. ST. V. B. DOWN and J. SNODGRASS.

Wardian cases were despatched during the year to the Royal Gardens, Kew, to Messrs. SANDER & SONS, and to Mr. C. CURTIS.

One hundred and thirty (approximate) packets of seed were sent out as exchanges or gifts, and 50 (approximate) packets of seeds were sold.

Four hundred and eighty-two plants were sent out as exchanges or gifts, and 5,090 plants were sold.

The following plants flowered in the Botanic Gardens for the first time:—*Capparis micrantha*, *Eria cepifolia*, *Porphyroglottis Maxwelliæ*, *Schismatoglottis coerulescens*, and *Sterculia carthaginis*.

Economic Garden.

A large map of the Economic Garden is in preparation with a view to the division of the area into numbered blocks, and to ascertaining how much of the irregular planting should be rectified for experimental work. As many of the blocks as possible will be treated commercially. Some foreign trees have already been cut out of the rubber land.

The old rubber experiments have now no more to teach; and as extra work is caused by adhering to the rotation in tapping entailed, they will be abandoned henceforward. The main future work will be an attempt to select the best seed parents; and in order to grow from them, the area has been cleared of all but sago palms which was in secondary jungle between the nine and the five-year old rubber.

A few experiments done in the Economic Garden have been mentioned above.

Acquisitions to the Economic Garden during 1913 have been:—*Feijoa sellowana* from Mr. L. G. REGNARD; a large race of *Spondias dulcis* from Mr. DUPONT (Seychelle Islands); *Aleurites montana* from the Hongkong Botanic Garden; *Prosopis juliflora* from Mr. J. F. C. ROCK (Honolulu); *Artocarpus odoratissimes* from the Department of Agriculture, Manila; a Bornean *Bassia* from Mr. ONG SOON LEE (Singapore); and four fibre Musas from the Department of Agriculture, Manila. To the donors of the above and also to the donors of seeds, etc., as follows, the acknowledgments of the Committee are recorded:—Messrs. G. P. OWEN, seeds of a race of *Achras sapota*; F. R. LONG, seeds of Gambier; W. E. VAN RIJNBERK, seeds of *Copernicia cerifera*; Professor H. H. W. PEARSON, seeds of the Tsammu melon of South Africa; the Director of Agriculture, Kuala Lumpur, suckers of *Agave* and *Furcraea*; and the Superintendent of the Royal Botanic Gardens, Calcutta, seeds of *Swietenia Mahagoni*.

In consequence of the clearing of secondary jungle from the back of the Director's house, an Alligator Pear tree growing there, fruited freely and a supply of young plants has been raised from its seeds.

1,880 lbs. of rubber were made.

83,200 seeds of *Hevea brasiliensis* were sold.

5,100 seedlings of *Hevea brasiliensis* were sold.

18 packets of other economic seeds were sent out.

2,824 economic plants, other than *Hevea*, were sold.

Waterfall Gardens, Penang.

The Municipal Band played in the Gardens twice during the year after the dinner hour, and large numbers of visitors attended to listen.

Roads to a length of 400 feet have been re-metalled. Granite steps have been placed on the ascent to the bandstand: these steps were obtained from dismantled bungalows in the catchment area, and in giving them and other similar material the Municipal Commissioners have been very generous.

As heavy rains have in the past caused considerable damage to banks, roads and paths, and as they furrow the lawns and wash manure out of the flower-beds, catch-water drains have been cut across the steep slopes at the edge of the jungle in places where they do not show:—one on the hill side above the office is 326 feet long, and another on the opposite hill-face is 220 feet long.

Two plant sheds were re-roofed with split bertams, from the adjoining jungle with garden labour.

A large *Casuarina* situated in the very centre of the Garden was felled, as it obstructed views of the Waterfall and was altogether out of keeping with its surroundings. Other trees have been pruned and cut back to open views.

Acquisitions.—Arum lily roots were received during the year from the Hon'ble R. YOUNG, *Celtis cinnamomea* from Mr. L. M. BELL, and *Kokia Rockii* from the United States Department of Agriculture. The last named damped off completely in Singapore, and partly in Penang: but two plants have been saved.

The display of new sets of *Caladiums* and of orchids in the early part of the year was very good. *Decaschista pulchra* which was obtained by Mr. HANIFF on an expedition to Setol, has been bedded out near the bandstand, and is very effective at a distance looking like a deep coloured sweet briar, though rather harsh when viewed closely. It was once in the Singapore Gardens, but lost there. However it produces seeds freely in Penang.

The following plants have flowered in the Gardens for the first time:—*Cochlospermum Gossypium*, *Ilex dahoon*, *Swietenia Mahogani*, *Bignonia gracilis*, *Raphia vinifera*, *Brassia verrucosa*, *Cypripedium callosum* (a variety from Siam), and *Renantherella histrionica*.

3 packets of seeds were sent out as exchanges.

25 packets of seeds were sold.

355 plants were sent out as exchanges.

848 plants were sold.

125 pounds of rubber were made.

Government House Domain, the two Plantations and Coconut inspection in Singapore.

The effect of changes, made in 1912, at the south entrance to the Government House grounds is becoming apparent. Showy trees have now been planted, such as *Spathodea campanulata* and *Cassia javanica* to replace dull foliage trees on the west side of the Edinburgh Road. Round the borders of the grounds a considerable amount of clearing has been done, and the planting of bushes and small trees continues.

The hybrid tobacco, *Nicotiana Sanderæ*, flowered at Government House, for, it is believed, the first time in Singapore.

The rubber ground on the Goodwood estate has been cleaned twice. The planted area on the Mount Zion coconut plantation has been increased.

Under the Coconut Trees Preservation Ordinance, 149 notices were served on 75 owners for the removal of that in which beetles were breeding. No cases were taken to Court; but a sudden change in the management of a certain estate alone prevented one from being so terminated. The Palm Weevil has been unduly abundant during the year as a consequence of the cutting of young coconuts out of land inter-planted with rubber or in one case for rubber: and of the ignorance of the owners that they must completely remove and destroy the coconut trunks before beetles have found a lodgment.

For public instruction an article on the coconut beetles was published in the "Gardens' Bulletin."

Coconut inspection in Malacca and elsewhere is carried out independently of the Gardens' Department: but the coconut plantations in parts of the Settlements visited were examined by the Director on tour.

There was a small outbreak of the coconut pest, *Brachartona catoxantha* in Province Wellesley, and a serious one in Singapore Island.

**Revenue and Expenditure of the Committee for Management of the Botanic
Gardens, Singapore, for the year 1913.**

REVENUE.

	\$	c.	\$	c.
By balance in Bank on 1st January, 1913 ...	572	69		
„ Cash in hand ...	100	00		
„ Government Grant ...	7,950	00		
„ Sale of prepared rubber ...	2,661	35		
„ Sale of plants and seeds ...	7,374	83		
„ Bank Interest ...	36	62		
			18,695	49

EXPENDITURE.

	\$	c.		
Salaries ...	8,931	33		
Other charges ...	6,640	75		
Cash in hand ...	100	00		
Balance in Bank on 31st December, 1913 ...	3,023	41		
			18,695	49

**Government Grant and Expenditure on the Botanic Gardens, Penang,
for the year 1913.**

	\$	c.	\$	c.
By Vote in Colonial Estimates...	4,500	00		
„ Supplementary Vote ...	460	00		
			4,960	00

EXPENDITURE.

	\$	c.		
Salaries ...	3,922	30		
Other charges ...	1,029	54		
Balance in Treasury on 31st December, 1913 ...	8	16		
			4,960	00

Revenue made by the Waterfall Gardens and paid into the Treasury.

	\$	c.	\$	c.
By sale of plants ...	468	15		
Miscellaneous ...	1	00		
			469	15

I. HENRY BURKILL,
Director of Gardens, S. S.

SINGAPORE, 18th April, 1914.

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS,

STRAITS SETTLEMENTS,

FOR THE YEAR

1914

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1915.

Annual Report of the Director of Gardens, Straits Settlements, for the Year 1914.

The Committee of Management for the Gardens, Singapore, consisted of His Excellency Major-General T. E. STEPHENSON, C. B., Hon'ble A. M. POUNTNEY, Hon'ble F. J. PIGOTT, Hon'ble F. M. ELLIOT, Messrs. W. E. HOOPER, and ST. V. B. DOWN together with the Director of Gardens: and when the first-named retired, Mr. W. LOWTHER KEMP was appointed in his place.

On the suggestion of the Director of Gardens the Government grant for labour in the Economic Garden was put under the control of the Committee—a rounding off which goes no little way towards knitting the Gardens together and simplifies administration.

For the easier control of the Government House Domain, the Aide-de-Camp to His Excellency the Governor and the Director of Gardens were constituted a committee of management with effect from the commencement of the year.

The Forest Department asked if the Gardens Department would take over the Kubang Ulu forest experimental ground in Province Wellesley, as they had also asked regarding the mixed plantation on Government Hill, Penang, at 1,800 feet: and it was decided as there are few trees on the latter and none on the former which are not in the Waterfall Gardens, that extension by taking them over cannot be recommended.

Finance.

The budget allotments for the year, exclusive of items on the vote of the Public Works Department, were:—Central Staff, \$15,405; Penang Staff, \$1,948; Government House Staff, \$780; Singapore Coconut Inspection, \$690; Malacca Coconut Inspection, \$512; Maintenance, etc., Singapore Gardens, \$12,536; Maintenance, Penang, \$5,885; Maintenance, Rubber ground of the Goodwood Estate, \$900. The grants which were needed during the year for locust suppression in Malacca were made to the Resident.

Revenue amounting to \$7,418.94 was realized in Singapore, and to the amount of \$548.06 in Penang.

Expenditure in Singapore has been above the income, so that the available funds are again reduced:—

	<i>January 1st, 1914.</i>	<i>January 1st, 1915.</i>
	\$ c.	\$ c.
In the Bank and in hand ...	3,123 41	1,553 72
Outstanding debts ...	426 25	366 09
Value of rubber in hand ...	625 01	1,224 00
	<hr/>	<hr/>
Total ...	\$4,174 67	\$3,143 81
	<hr/>	<hr/>

On December 31st, 1914, advance payments were held to the amount of \$513.01.

The Gardens' Committee has decided to increase the revenue from rubber, if possible.

Buildings.

The Public Works Department removed the larger kiosk (old monkey house) to a new site near the Five-ways where it serves as a shelter for visitors caught by rain in the northern part of the Botanic Gardens. Petty repairs were done by them to other structures. The Gardens' Committee repaired the rubber-smoking house and rebuilt the orchid propagating-house at the Assistant Curator's quarters. In Penang the Public Works Department was occupied in the erection of cooly lines for a sufficiency of men, and quarters for the sub-overseer and record-keeper.

The Gardens' office, Singapore, was broken into on the morning of June 18th; but nothing stolen, the safe foiling the thief. The watchman detailed for duty at the time, at the least neglected his rounds and was subsequently dismissed. A watchman's clock is being put into use, for the better control of the night duty.

Records and Investigations.

In connection with pests, it is to be recorded that the measures taken against the moth—*Brachartona catoxantha*—in Singapore island proved the right ones: having discovered a parasitic fungus which attacks the caterpillar, a special inspector was detailed to distribute that fungus to all colonies of the moth which were not already infected. The fungus which was new to science, has been described at Kew as *Botrytis necans*, Massee. On request some of it was sent to Fiji for trial there against a sugar-cane caterpillar.

In August, Mr. P. C. COWLEY BROWN was put in charge of measures against the locust (*Pachytilus migratorioides* or a closely allied species) in Malacca. It is not too early to state that he has done very well: but the results of his 4½ months' work in 1914 may be reported on most conveniently later.

The granting of certificates of freedom from pests on plants for export, has been entrusted to the Gardens' department (*vide* the Government *Gazette* of August 7th, 1914), and preparations have been made for carrying out the duty effectively. When the Assistant Director has joined the department and the laboratory has been built, the work of studying these pests will make great strides. Insect enemies meanwhile found within the Gardens are being identified by the help of several entomologists. Mr. E. E. GREEN has determined some coccids, Dr. R. HANITSCH, Mr. H. C. PRATT and the Imperial Bureau of Applied Entomology insects of other groups.

The damage by rats (?) to the books of the library continues: a variety of traps, and poison have been used against them, and the ventilators have been covered with fine wire netting. Binding together with the poisoning and varnishing of the covers protects the books, the damage being done to what is in paper covers. Unfortunately there are hundreds of volumes awaiting binding, an accumulation of several years which can be reduced but slowly. One hundred and two volumes were bound in the jail and 97 outside during the year.

The cabinets in the Herbarium building have been rearranged so that they no longer interfere with light and air; the work-tables have been brought up to the east windows, and the removal of big overshadowing trees on the west side has been completed. The improvement resulting is very great. Following it up, the record-keeper has numbered all the generic covers—those of the Phanerogams by Bentham and Hooker's *Genera Plantarum*, those of the Cryptogams by Engler's *Pflanzenfamilien*. These at least are now arranged in sequence; but the ordering of the species within the genera is a matter of years.

Herbarium specimens have been received as follows:—

132 from Mr. H. N. RIDLEY, being specimens collected on the mountains of Selangor, by Mr. H. C. ROBINSON.

99 from the Royal Botanic Gardens, Calcutta.

970 from the Bureau of Science, Manila, and a few from Mr. H. B. MARSHALL (Brunei) and Dr. J. D. GIMLETTE (Kelantan).

Specimens were sent out as follows:—

88 to the Royal Botanic Gardens, Kew.

150 to the Bureau of Science, Manila.

36 to the University of Cambridge.

28 to the Royal Botanic Gardens, Calcutta.

In the Kew Bulletin (1914, pages 72-76 and 357-359) have appeared descriptions of some of the fungi collected in the Botanic Gardens, Singapore, or near thereto. In the Gardens' Bulletin will appear an enumeration of the Pahang collection of Phanerogams made by the late Mr. A. M. BURN-MURDOCH, and worked out by the Director during 1914.

Historic samples of rubber preserved in the Museum were put up in show tins for loan to the Batavia Rubber Exhibition, where the exhibit obtained an Honourable Mention.

In December, Mr. FREDERICK BROWN of the Greenwich Observatory, was permitted to establish a temporary station for the observation of terrestrial magnetism near to the Cluny Lake. The position was marked by a stone that the survey under the auspices of the Carnegie Institute, Washington, for which he is working, may be able to return to the exact spot.

An important preliminary step towards a guide to the Gardens has been taken. In Mr. RIDLEY'S Guide of 1889, long out of print, the whole of the grassy part of the Gardens was divided into lawns indicated on his plan by letters, and the visitor was told for instance that he could find the Copal Varnish Tree on Lawn L, or the Funeral Cypress on Lawn E. In 1911, a large percentage of the trees were numbered by Mr. ANDERSON in order that labels removed for any purpose might be replaced correctly. When later Mr. ANDERSON compiled the Gardens' Catalogue, these numbers were cited: and in a measure they serve as guides to the position of trees, because No. 1 is by the Main Gate and the numbering proceeded thence: but intercalation occurs making difficulties. The reader will see at once that by combining a lawn letter with the number, something much more useful is obtained: and accordingly on a large plan specially supplied by the Survey Department, the Botanic Gardens have again been divided into lettered areas; the Record-keeper has punched the letters on to the labels wired to the trees, and has commenced a manuscript catalogue which will be a complete inventory of the woody, that is permanently placed, vegetation of the open parts of the Garden. The Copal Varnish Tree is now B8, and the Funeral Cypress J225.

Botanic Gardens, Singapore.

At the full-moon in each month, except April, up to the outbreak of the war, the band of the King's Own Yorkshire Light Infantry played in the Gardens by the kind permission of the officers of the Regiment. Their bugles played frequently for the children and on several Mondays the band of the 3rd Brahmans played.

Roads were extensively repaired by the Public Works Department, commencing September 30th; and the work was well done. The Gardens' Committee kept in order the paths and cut two new ones—one from the Tyersall Gate towards the bandstand, the other past the new site of the large kiosk to join the jungle path.

The overflow channel of the lake was repaired, and advantage taken of the lowness of the water to remove some of the banks which had formed. Part of the soil so recovered was set aside for the raising of a path, and part used for flower beds and pot plants. It may be mentioned in passing that the success at the end of the year of the beds of Turk's-cap Amarants at the bandstand was due to lake-soil having been used.

The Cluny Lake was deepened to three feet by the Public Works Department, and the adjoining swamp filled in. In deepening the Cluny Lake a bed of very fine granite sand was struck so fine as to be greasy when wet, and in digging a temporary well in the north-east corner of the Economic Garden an exactly similar sand. It appears therefore that this sand may underlie the whole rubber ground.

With blocks of stone recovered from the foundation of the old monkey house and on a bed of coral a small rockery was made over the Palm Valley on the slope which gets the first sun, whereon Agaves and a Furcraea brought from Kuala Lumpur were planted. The rockery is experimental in order to see if the Gardens' collection of such plants can be better grown. On the rockery *Helianthus occidentalis* was planted out with the Agaves and flowered. It is noteworthy that there is no "sun-rockery" in the Gardens, and that the device of forcing flowering by means of the heat off rocks or a wall, as far as the records show, has never been tried. Should this rockery be a success a whole line limiting the palmetum towards the Director's house might be made with effect, and a now closed path reopened to lead to a pleasing view over the Cluny Lake.

Of trees the greatest loss was the tall *Araucaria excelsa* which stood near the Herbarium: it fell on June 7th, by an attack of white ants. And near the Five-ways a rare *Cinnamomum* was killed by the same pest. On May 12th, at 8-30 P.M., some,

1018' 9" N
103° 48' E

3/97

mischievous person set fire to a clump of *Raphia* palms by means of an acetylene torch, apparently thrown from the Cluny Road: and at the end of the long drought a Municipal cooly, burning leaves near the Tyersall gate, carelessly set fire to the Gardens' fence, destroying among other plants a large *Grammatophyllum*.

Six petty thefts were detected, but none of them important enough to prosecute.

Owing to the unusually warm dry weather, there was a prodigal flowering of some plants: the Tembusu trees were yet more profusely covered with flowers than usual: and *Grammatophyllums* flowered very freely.

Clerodendron fallax has proved a good bedding-out plant. *Melaleuca hypericifolia*, stated a year ago to be a success, will not bed out: it is still growing in a pot, but the statement of the last report must be modified. The *Nymphaeas* in the lake continue to do very well: the success with them may be attributed largely to the keeping of the water cleaner. *Acer heterophyllum*, obtained from Mr. L. G. REGNARD, Mauritius, promises to do well. *Hedychiums* obtained from Kew in 1913 will shortly flower. Hybrid *Nelumbiums* have been obtained from Messrs. Dreer of Philadelphia. *Dipladenia amabilis* has been obtained from Mr. H. C. BARNARD, Kuala Lumpur. A collection of orchids has been acquired from Messrs. Sander and Sons, partly by exchange and partly by purchase. *Cypripediums* have been obtained from Commander DÉRY of Bangkok by exchange. And from Kew the Assistant Curator was allowed to bring back a very welcome assortment of tuberous and bulbous plants.

Messrs. ST. V. B. DOWN (orchids and coconuts), F. J. HALLIFAX (orchid) and H. OVERBECK (*Amorphophallus Rex*), very kindly gave plants to the Gardens. Plants were received by exchange from Messrs. M. HERB, Naples; L. G. REGNARD, Mauritius; and M. BUYSMANN, Java, and also from the Department of Agriculture, Mauritius, the Superintendent of Forestry, Taihoku, Formosa, and the Superintendent of Plantations, Thaiping.

Two thousand two hundred and thirty-nine plants were sent out, and 253 packets of seed. Ornamental shrubs in some quantity, were supplied to the Pearls Hill School, Singapore, and to the European Hospital, Malacca.

Economic Garden.

The Economic Garden has three natural divisions: there is the low ground, the slopes, and the hill-top. The second is planted as an Arboretum: the other two are intended to be used entirely in blocks for special cultivation. Taking the low land in hand, Mr. BRADBURY commenced the division of it into blocks of which there are fifteen. Six of these blocks are given over wholly to rubber, and from some of them the cutting out of intermixed trees, commenced in 1913, had to be continued. Tapping which had been stopped on March 14th, in view of the change foreshadowed in the last report, was recommenced by blocks on May 26th.

The drought caused extra work in watering young plants.

Into Block 11 the collections of pineapples and pisangs were transplanted. Both had had bad situations; and among the pisangs many races have been lost. A large part of Block 12 was planted up with Tembusu that a supply of kassows and later of timber may be got.

A few beds in the nursery were planted up with all the local races of sugar cane. In the same place two races of *Passiflora foetida* are being studied, the growth of mulberry bushes and of *Dolichos Hosei*, a new cover crop-grown investigated. It has proved easy there to raise *Cymbopogon Martini*—the Palma-Rosa oil grass from seed obtained from Calcutta: but it is very hard to transplant it. Young plants of *Eriobotrya japonica*—the loquat—are at present growing well.

The experimental cultivation of *Hedychium coronarium* has been continued, but promises nothing on the soil of the Economic Garden in the sun.

The study of yams continues: and a report will appear in the Gardens' Bulletin. Several edible tubers have been received from Mr. C. E. F. ALLEN, Curator of the Gardens, Port Darwin, notably the Asclepiad *Macrostemma tuberosum*, *Dioscorea alata*, and an *Amorphophallus* near, if not, *campanulatus*. Tubers of *Dioscorea bulbifera*, var. *suavior*, have been received from Mr. MANSON BAILEY, Government Botanist, Queensland, and of several species from Professor C. F. BAKER, Los Banos, Philippine Islands, the Department of Agriculture, and Mr. E. D. MERRILL, Government Botanist, Manila.

From Garden seed, the foreman-gardener by patience raised a stock of the Brazil-nut tree, which can now be sold to the public.

Latex was supplied to two experimenters. To Mr. WALTER JACKSON the Gardens were much indebted for finishing off the smoking of some rubber wanted at an earlier date than the Gardens' method of curing would have given it.

2,685 lbs. of smoked rubber were prepared.

360,000 seeds of *Hevea brasiliensis* sold.

3,000 seedlings of *Hevea brasiliensis* sold.

10 consignments of economic seed other than *Hevea* sent out.

761 economic plants other than *Hevea* were sold.

Granite posts kindly supplied by the Public Works Department were set up at the gates to prevent unauthorized entry of carts, and a chain with a lock hung across the way in from Cluny Road.

Waterfall Gardens, Penang.

The supplementary grant for the Waterfall Gardens of \$925 enabled a considerable amount of work to be carried through, e.g., the Bandstand hill was crowned with a ring of granite posts connected together with chains, the old mill dam was repaired, the foundations of a dam laid above the Middle Bridge, and metalling obtained and laid along the whole of the Lower South Road and the Upper Central Road.

The bandstand now looks purposeful, and the fall over the mill dam is a great improvement as well as the resulting filling in of the rough stream bed above it.

It is not quite certain—but probably correct—that the dam formerly served to maintain a head of water for a mill working in the valley below, and that at another time a pipe line was laid from above it to the Cantonment. But freshet after freshet, fretted the south bank on to which a large boulder deflected their force, so that in 1908 the stream was able to work round the dam. The Overseer has removed the offending boulder, and made so strong an embankment that there is little fear of it breaking again.

The embankment is faced with boulders taken out of the lawns which are smoother by their removal.

The dam above the middle bridge is intended to preserve the south bank of the stream at a point so near to the bridge that the latter will go if the destruction of the bank is allowed to continue. The water will be thrown straight towards the bridge over three slightly curved steps. The banks above the dam are being strengthened by means of stones in wire cages. To get the stones required without seeking them from far away, it was decided to dig out a knoll on the north side at a point where the gradient of the Upper North Road was too steep, and to turn the road in it.

With girders kindly given by the Municipality of George Town, three small bridges have been made: two are over the stream just below the pipe aqueduct, and one is on the stream side path: granite slabs are laid on the girders. These bridges replace decayed wooden structures. A part of the adjoining lawns have been dug over for lailang; and two drains have been laid in the swamp which is below the Reservoir. Granite posts have been set on either side of the embanked part of the Upper South Road, and will be connected together by chains.

There is a hollow close to this embankment where *Nelumbiums* used to be grown; but so much silt now comes down to the place from the Hill Road that the *Nelumbiums* have been killed: the silt is being used to fill up the hollow as that is the best alternative.

Two *Angsana* trees have died on the north side of the Garden, and one large tree has been removed on the south side to give room to the neighbouring *Dacrydiums*.

The flowering and seeding of *Eucalyptus corymbosa* in the upper part of the Garden must be recorded as it has furnished a stock of 50 seedlings in Singapore and 80 in Penang, wherefrom it is expected that the public can be supplied. The same *Eucalyptus* fruited on the Kubang Ulu reserve in Province Wellesley. A curious variety of *Grammatophyllum speciosum* flowered: it is distinguished by the number and small size of the spots on the flower.

The Garden was enriched by 731 desirable plants collected on the Overseer's trip to Lankawi, by the gift from Mr. A. A. ANTONY of cuttings of several showy plants, of *Dipladenia amabilis* from Mr. BARNARD, and an orchid from Mr. EDWARD. Further a number of plants were brought in from the Singapore Gardens.

By exchange or gift, 15 packets of seed were sent out and 155 plants. Eighty-seven orders for plants were met, resulting in revenue as above stated.

Coconut Inspection.

Under the Coconut Trees Preservation Ordinance 110 notices were served on 89 owners for the removal of that in which the beetles were breeding or likely to breed. No cases were taken to court; but in the matter of the Mount Zion Dairy Farm (in liquidation) the advice of the Deputy Public Prosecutor was taken and he settled a case out of court by obtaining from the surviving liquidator the expenditure incurred by the Gardens in turning over a large accumulation of manure and destroying not less than 5,000 grubs.

The Goodwood Estate Rubber land was cleaned twice; and after the second cleaning the planting of a smother crop was commenced with a view to the killing out of a nodular rooted sedge which cannot be destroyed by digging, and is the great pest there.

The Mount Zion coconuts planted in December, 1910, have commenced to flower.

Revenue and Expenditure of the Committee for Management of the Botanic Gardens, Singapore, for the year 1914.

REVENUE.

	\$	c.	\$	c.
By balance in Bank on 1st January, 1914 ...	3,090	69		
„ Government Grant ...	12,036	00		
„ Contribution for Mt. Zion plantation ...	254	00		
„ Contribution from Editor, Gardens' Bulletin ...	174	20		
„ Advance payments for seeds and plants ...	209	82		
„ Sale of prepared rubber ...	1,666	16		
„ Sale of seeds and plants ...	5,752	78		
„ Recoveries, etc. ...	790	64		
			23,974	29

EXPENDITURE.

	\$	c.		
Salaries and wages ...	14,267	68		
Other charges ...	8,152	89		
Balance in Bank on 31st December, 1914 ...	1,553	73		
			23,974	29

Government Grants and Expenditure on the Waterfall Gardens, Penang, for the year 1914.

GRANTS.

	\$	c.	\$	c.
By Vote in Colonial Estimates... ..	4,960	00		
„ further vote for special improvements	925	00		
			5,885	00

EXPENDITURE.

	\$	c.		
Salaries and Wages	4,779	51		
Other charges	1,092	47		
Balance in Treasury on December 31st, 1914	13	02		
			5,885	00

Revenue made by the Gardens, Penang.

			\$	c.
And paid into the Treasury	...	...	548	06

Revenue and Expenditure of the Committee for the Management of the Government House Domain, for the year 1914.

REVENUE.

			\$	c.	\$	c.
By votes in the Colonial Estimates	...		6,440	00		
„ revenue	...	...	699	11		
			————		7,139	11

EXPENDITURE.

Salaries and wages	...	...	5,755	81		
Other charges	...	...	1,049	29		
Balance in Bank on December 31st, 1914	...		334	01		
			————		7,139	11

I. HENRY BURKILL,
Director of Gardens, S. S.

SINGAPORE, 30th April, 1915.



STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command of
His Excellency the Governor.

Annual Report of the Director of Gardens, Straits Settlements, for the Year 1915.

The Committee of Management for the Gardens, Singapore, consisted of the Hon'ble A. M. POUNTNEY, Hon'ble F. J. PIGOTT, Hon'ble F. M. ELLIOT, Messrs. W. E. HOOPER, ST. V. B. DOWN, and W. LOWTHER KEMP, together with the Director of Gardens. When the third-named left the colony, Mr. E. E. ADAMSON was appointed in his place.

There were no changes in the staff such as need record here. The services of Captain T. F. CHIPP, Assistant Director, remained under the War Office, and his post was unfilled.

Finance.

The budget allotments, including extensions, were:—Central Staff, \$19,545; Penang Staff, \$1,824; Government House Domain Staff, \$840; Singapore Coconut Inspection, \$690; Malacca Coconut Inspection, \$548; Maintenance, etc., Singapore Gardens, \$12,376; Penang, \$4,960; Government House Domain, Maintenance, etc., \$5,456; ~~Maintenance, etc., Gardens, Maintenance, etc.,~~ Goodwood Estate rubber-land, \$900; Singapore travelling expenses, \$1,000; Gardens' Bulletin, \$120.

Out of these sums at the end of the year upwards of \$4,000 was undrawn of that for the Central Staff, \$621 of that for the Goodwood Estate, \$183 of that for travelling, and some smaller sums.

By sales of plants and seeds, by recoveries, etc., the Gardens' Committee realized \$8,740; and by sales \$833 was realized in Penang. A tabular statement is appended to this report which shows how the funds of the Gardens' Committee were used. The expenditure was less than the income.

The position of the Committee on the first day of 1916 and of the three preceeding years may be given in the following statement, cents omitted:—

	1913.	1914.	1915.	1916.
	—	—	—	—
	\$	\$	\$	\$
In the Bank and in hand ...	672	3,123	1,553	2,777
Outstanding debts to the Gardens ...	2,833	426	366	439
Value of rubber in store ...	1,379	625	1,224	882
Making ...	4,884	4,174	3,143	4,098
Less advance payments ...	252	585	513	303
Total ...	4,632	3,589	2,630	3,785

The Committee owe their savings in part to the Gardens' rubber crop, and in part to having had no extensive repairs to do. But these savings are ear-marked for repairs which are in sight.

The revenue of 1915 (being \$8,740) came from the following sources:—

	\$	\$
By the sale of economic plants and seeds ...	1,588	
By the sale of ornamental plants and seeds ...	1,069	
By the sale of rubber ...	4,105	
	<hr/>	6,762
By recoveries of the Gardens' expenses in connection with those sales (packing) ...	456	
(cartage and freight) ...	334	
By recoveries not connected with sales and by bank interest ...	1,188	
	<hr/>	1,978
		<hr/>
		\$8,740

The year 1915 is the first in which the accounts have been kept on a system intended to afford analyses of the revenue: the percentage which recoveries make out of the total amount of the bills for sales is found to be 23, and therefore greater than the 20 per cent of earlier and rough estimates.

While the clerk has been required to keep his bill-books posted up in greater detail, the foremen gardeners have been taught to make correspondingly detailed returns of the directions in which labour is used, for the prevention of waste and that the Gardens may not work at a loss in the raising of plants for sale, etc.

Buildings.

The Gardens' Committee rebuilt in Singapore both the potting sheds, a foreman-gardener's house, the kitchen of and the bridge into the Javanese cooly-lines. The Public Works Department in Penang completed the cooly-lines and the houses of the Record-keeper and Sub-Overseer.

Records and Investigations.

INSECT-PESTS have not caused much damage within the Gardens. Such as appear are studied for two purposes, (i) that they may be checked, and (ii) for the sake of the inspection of plants for export, which duty demands a knowledge of the habits of pests. *Crinum asiaticum* has, as before, been made unsightly by the caterpillar of *Calogramma festiva*, and Cycads by that of *Catochrysops pandava*. Pisang leaves and particularly the leaves of Manila hemp, have been attacked by the caterpillar of *Erionota thrax*. Hand-picking is the remedy in all these cases; but it is also necessary in the case of the Cycads to remove the injured young foliage. The grub of a small Microlepidopteron damaged Avocado pears at the end of the crop. The caterpillar of a Wood-leopard moth (very similar to *Zeuzera coffea*) killed to the ground stems of *Bauhinia candida*. Three caterpillars were found on the foliage and shoots of *Dioscoreas* and reported on in the "Gardens' Bulletin."

The Red Palm-Weevil *Rhynchophorus ferrugineas* killed two or three palms of the genus *Cocos* and the allied *Xylotrupes gideon* killed stems of *Pinanga*. A small undetermined beetle did a considerable amount of harm in Penang to the foliage of *Nymphaeas*.

An Aphid attacked *Areca* foliage in large numbers in Singapore; and the surface was subsequently blackened by a fungus growing in the excretions of the insects.

Several Coccidae have been sent to Mr. E. E. GREEN who was so kind as to name them.

In Singapore Island there has been an outbreak of the moth *Brachartona catoxantha* in Geylang: and in this case Nipa palms associated with the Coconut palms were also attacked. The area affected was inspected from time to time; but as the fungus *Botrytis necans* was present abundantly and killing the pupating caterpillars, no further action was called for.

Mr. P. C. COWLEY-BROWN remained in charge of locust destruction in Malacca until November: and it is believed that the swarms of locusts have been diminished by his work. A report on the locusts will be printed in the "Gardens' Bulletin."

There has been some increase of the Red Palm-Weevil in Malacca due to the cutting out of coconuts from among rubber and neglect to remove the trunks. The same kind of cutting out is proceeding in the Province Wellesley; but an increase of the Red Palm-Weevil has not been noticed there.

FUNGUS-PESTS, except *Fomes semitostus*, have done little damage within the Gardens. *Uredo Dioscoreae* was rather abundant on some experimental yams, but does not cause death. The former took toll in a number of rubber trees from blocks 1, 4 and 5 of the Economic Garden, and appeared newly in block 2, which was thought free, until a tree, falling, revealed among its roots part of an old log which had served as a nidus for the fungus.

The "GARDENS' BULLETIN" was published twice. The first of the two numbers contained an account of tapping in the Economic Garden from its commencement to March 14th, 1914, when the old system of grouping of trees was superseded by the division into blocks. The second contained various reports, e.g., on yams, on the seeds of *Canarium rufum*, on the rainfall of 1914, and an enumeration of plants collected in Pahang by the late Mr. A. M. BURN-MURDOCH. The Bulletin brings in 43 exchanges.

For the Gardens' LIBRARY two new pigeon-hole almyrahs have been made to hold unbound serials. Pamphlets to the number of more than 1,300 have been bound into 117 volumes by subjects. Of other volumes 129 have been bound in the jail and 7 outside. The measures taken to guard the books against rats have been successful.

From the HERBARIUM the following specimens were sent out:—

- 60 species to the Royal Botanic Gardens, Kew.
- 146 species to the Royal Botanic Gardens, Calcutta.
- 57 species to the University of Cambridge.
- 226 species to the Bureau of Science, Manila.
- 48 species to the Botanic Gardens, Buitenzorg.

The department has botanized in the following places:—Pulau Tinggi and Pulau Tiuman, the Settlements and in the Negri Sembilan on the Malacca border (the Director), about Kedah Peak and in the hills north of Alor Star (the Overseer of the Waterfall Gardens), interior of Sarawak (a collector put under the supervision of Mr. J. C. MOULTON). To Mr. H. C. ROBINSON, Director of Museums, Federated Malay States, the department was indebted for the chance of collecting on the two islands first named.

The bringing of the Singapore and former Penang herbaria into one series has been continued. The whole of the collections have been re-poisoned.

A special investigation has been undertaken in conjunction with Mr. G. E. S. CUBITT, Conservator of Forests, on the Dipterocarps.

Botanic Gardens, Singapore.

There were no band-nights at full-moon during the year; but the officers of a French warship, of a Japanese warship, and of the regiment stationed in Singapore, were so good as to send their bands on different occasions to play in the Gardens at sundown.

There were no labour troubles during the year; and to the credit of the subordinate staff it is to be said that there was but a single day's interruption of work when in the latter part of February the European supervision was called away.

More thefts than usual occurred; three thieves caught on different occasions were convicted in court and sentenced. The worst thieves escaped. The thieving was chiefly from the Economic Garden: but the most annoying theft of all was from the Botanic Gardens, being of an orchid newly labelled. It had been intended to label the orchids set out all over the Gardens on trees, as they flower and are determined: but as the first labelled was stolen within two days of the labelling, the Public cannot have this intended advantage: instead, a list will be kept in the Gardens' office in the following form "*Dendrobium superbum* on tree J 706."

The monkeys in the Gardens proved very troublesome: they visit the plant-houses for tender shoots: they have destroyed sugar-cane and pine-apples in the Economic Garden, tearing out the young leaves of the latter as well as biting the fruit: and they have repeatedly broken down and bitten back the shoots of the experimental yams. With the clearing of the land round the Gardens these animals have come to depend for their food less and less on wild sources and more and more on what is cultivated.

A coral rockery has been made in a triangle of three paths between the Gardens' lake and the Herbarium. West of the Lake and on the Bandstand hill the paths have been repaired.

The bedding-out and the maintenance of a show of flowers in the plant-house *annexe* have been much improved. The first is due to the gradual organization of the nursery where the bedding-out plants are raised: the second to an increase in the number of men raising pot-plants by the employment of a Chinese gardener and to the making of high benches for his work in the sunniest spot available, namely, the rise west of the Cluny Lake. To Mr. J. W. ANDERSON, the Assistant Curator, considerable credit is due for his work in connection with these changes. Cannas, imported in 1913, and now first sufficiently multiplied, served chiefly for the bedding at the Main Gate. Roses have been put into the small round beds at the bandstand, because the constant replacing of herbs prevented the palms in the centre of each bed from progressing.

The Water-lilies in the lake have done well: intermediates have appeared among them. *Victoria regia* has been planted in the larger pond below the lake. Dr. N. ANNANDALE, Superintendent of the Indian Museum, Calcutta, who visited the Gardens in September, has confirmed the identification of the common small fish of the lake as *Haplochilus panchax*; a fish which has a great reputation for destroying mosquito larvæ. Dr. R. HANITSCH reported upon it three years ago in the Journal of the Straits Branch of the Royal Asiatic Society.

Work on the Dell above the lake has been continued. A path into it from the upper end has been made by cutting off a part from the leaf-mould pit, which lies above it. The shape of the mounds in the Dell has been altered in order to give room enough for visitors to walk through without touching the possibly wet vegetation.

The following bedding-out plants have been acquired, or re-acquired:—*Hibiscus radiatus* from the Director of Agriculture, Federated Malay States; *Asystasia travancorica* from Mr. R. M. RICHARDS, Nibong Tebal; *Tricholæna rosea* from Mrs. J. R. NICHOLSON, Singapore; and *Galphimia brasiliensis* from Mr. F. R. LONG, Pulau Bulang. Morning Glory from Japanese seeds, did so well in the Gardens at the end of the year that it will be used again. The Director brought back from Pulau Tioman, *Hæmaria discolor* var. *Ordiana*, *Dendrobium hercoglossum*, *Gastrochilus plicatus*, a new *Parabœa*, and some other plants; also from Port Swettenham, *Vanda Hookeriana* and *Renanthera elongata*. From other sources *Hæmaria discolor* (type) and *Calanthe rubens* were obtained. Fifty *Caladium* bulbs were acquired from London.

The Hon'ble I. K. CALDECOTT presented to the Gardens plants of a beautiful Bornean *Bauhinia* which has not been determined. The United States Department of Agriculture supplied more seeds of *Kokia Rockii* from which one healthy plant has been raised in Singapore; but it is feared that, like some other plants, it can only be kept alive by means of the artificial drainage of plant-pot culture, that is to say, it will be impossible to plant it out. *Melaleuca hypericifolia* raised, as recorded, in 1913, is still alive and healthy in a plant pot; but every attempt to plant it out has failed. Mr. R. G. FREEMAN was so kind as to send seed of *Warszewiczia* from Trinidad, but it failed. Mr. H. N. RIDLEY, who revisited the East, presented seeds collected in Borneo.

In all 1,240 plants were received in the Gardens and 541 packets of seed.

TREES.—The tall palms (*Actinorhysis Calapparia*) on the bandstand hill are one-by-one fruiting and dying. All the specimens of the palm *Wallichia disticha* are fruiting and will die. The best specimen of the palm *Kentia Woodfordii* was lost by the fall of a roadside tree on to it.

The common Box has been planted with success as a hedge. *Pandanus penangensis* and *Agathis robusta* fruited. *Livistona Woodfordii*, *Astrocaryum Malybo*, an unidentified Pandan, and *Araucaria Cookii* have been planted out. *Randia Mus-saenda* and *Oxyanthus natalensis* flowered for the first time.

Trees generally throughout the open parts of the Gardens have been mulched with leaf-mould; and in many cases with considerable benefit.

LAWNS.—From the drier lawns the South American grass *Paspalum platycaule* is being removed, as it ousts the finer grasses, grows twice as fast, and consequently requires the scythe twice as often. It has been in Singapore for a long time.

1,588 plants were sent out.

274 small packets of seed were distributed.

3,365 large seeds, such as *Raphia*, were sent out, and

20 lbs. of Tembusu seed,

Economic Garden.

An area on the hill top of about seven acres has been cleared, and stumping has been done over the larger part of it, with the intention of planting fruit trees. Against this planting a collector was sent to Malacca, where with the kind assistance of the Divisional officers, Messrs. M. SHERWOOD and F. J. MORTEN, he obtained durian seed from selected trees. Seeds of other fruit trees have been obtained from Penang and Singapore. And there is ready now a satisfactory stock of young plants. Fruit-trees have been obtained also from the Bureau of Agriculture, Philippine Islands, and from Mr. M. G. REGNARD, Mauritius. Planting-out will be commenced as soon as the land is ready: but it is desired to terrace it first for the retention of soil.

An appeal may be made here for help in the work of building up an orchard for selection purposes, namely, that those who know of the whereabouts of the most excellent of fruit trees would be so good as to inform the Gardens' department.

Mr. A. S. HAINES has been so kind as to send several fruit trees from Kuala Kangsar.

The collection of pisangs in the Garden has been augmented; and as the older plants fruit their proper Malay names are attached to them.

During the year 48 packets of economic seeds were received together with 2,318 durian seeds, 189 young plants and 175 tubers.

Block 7 has been laid out in beds carrying samples of local sugar-canes, the *Sansevierias*, patchouli, *Andropogon Martini*, and *Hedychium coronarium*. Across the sago land behind it (blocks 8-11) a new drain has been cut, which converges on to the road-side drain through block 12, and discharges into it at the extreme north-east corner of the Garden. Much is hoped from this drain; for the drains of the old system on account of the angle at which they discharged, were always blocked by silt after flood water had come down the side of the Bukit Timah Road in any quantity.

The rubber trees except those of block 12, were tapped in rotation. The good trees were marked by a green cross and the very bad trees by a red cross. This is the commencement of the selection work mentioned in the last report.

Most of the Eucalypts raised from Penang seed have been planted out in the Economic Garden, either in front of the Tamil cooly-lines or on the east boundary. From the Department of Agriculture, Java, selected coffee seed was generously given; and from the Department of Gardens and Forests, Hongkong, seed of *Aleurites Fordii*. A good supply of seedlings from both has been raised. African yams were received through Kew, from the Gold Coast and from Southern Nigeria, and some Indian yams and Fijian yams from the Superintendent of the Royal Botanic Gardens, Calcutta. These were grown, first, immediately behind the Director's house; but when the crop matured, two-thirds of the whole collection, viz., the races of *Dioscorea alata* and *Dioscorea aculeata*, found a place in block 14. Also in block 14 have been planted patches of *Derriis elliptica* and *Dolichos Hosei*.

Latex was supplied to three experimenters.

4,292 lbs. of rubber were made,
219,000 seeds of *Hevea brasiliensis* sold,
18,400 seedlings of *Hevea brasiliensis* sold,
48 packets of economic seeds other than Hevea, sent out, together with,
450 large seeds, such as coconuts, *Elaeis*, etc.,
1,094 economic plants other than Hevea.

Waterfall Gardens, Penang.

During 1915, on the foundations laid in 1914, as described in the last report, a granite dam of three steps was constructed. But on October 16th, heavy rain wrecked it by eating under the foundations which had stood for a year. A considerable amount of stone, partly in wire cages and partly loose, had been thrown into the stream bed above the dam against any scouring action; but it did not suffice: the scour went down not less than six feet, shifting a boulder of about 60 cubic feet of granite from under the centre of the structure which then fell in by its own weight. It has been decided that on a bottom so soft, a further attempt at making a rigid dam will not be justified. But instead, as it is absolutely necessary to control the stream at the point, stones in wire cages will be used. There stands thirty feet higher up the stream a part of the masonry of the dam erected in 1895, which had a life of thirteen years; but to restore it would not serve any purpose in preventing the fretting of the banks immediately above the Central Bridge.

The middle dam which was re-established in 1914 has proved a great success, for the stream has covered up with sand the unsightly boulder bed which it had bared. Part of this bed will be reclaimed.

It was not possible within the year to complete the turning of the Upper North Road; but it will be finished in the first half of 1916.

The Penang Automobile Association moved in the matter of directing cars within the Gardens, and bore the expense of erecting two notice boards. The result is good.

It is annoying to have to record two thefts of ferns from the Plant-houses.

From the Entrance Gate to the Office, in the interspaces between the arrested trees of *Polyalthia longifolia*, where Rain trees stood until 1907, an avenue of *Poinciana regia* has been planted.

As a result of the Overseer's trip to Kedah, 262 plants, mostly orchids and palms were brought into the Gardens. A few tree ferns have been brought down from the Hill. The Overseer is continuing his experimental crossings of Hibiscus; and he has got the montane orchid *Spathoglottis aurea* to repeat its flowering.

The Hon'ble A. T. BRYANT, Resident Councillor, presented to the Gardens seeds of many races of Morning Glory; and the plants raised flowered exceedingly well. It is recorded in the Report for 1899 that Mr. CURTIS succeeded in that year with the same. Mr. LAWRIE C. BROWN was so good as to present plants of *Dipladenia*, Cannas and *Hibiscus*; *Aleurites cordata* and *Kokia Rockii* were raised from seeds from Singapore. *Widdringtonia Whytei*, the Mlanji Cedar, is still growing. *Areca glandiformis* fruited for the first time.

One hundred and forty-two orders for plants were met, and 160 plants were sent out by gift or exchange, including three cases of Filmy ferns to the Royal Gardens, Kew. Out of the revenue of \$833.75, \$212.35 came from some rubber made in 1913, but not sold. Deducting this, the sum realized from the sale of plants is found to be slightly increased.

Coconut Inspection, etc.

Under the Coconut Trees Preservation Ordinance 176 notices were served in Singapore Island for the removal of that in which beetles were or might multiply, and 463 in Malacca. No cases were taken to Court in Singapore, but 78 in Malacca, resulting in fines amounting to \$89.50.

The Goodwood Estate Rubber land was looked after on a new system resulting in a considerable saving: permanent labour was kept on it; and interplanting with Citronella grass done. Towards Stevens Road the Municipality was allowed to dump earth; for this, though injuring the rubber trees, makes the land more what it should be—a town site. Preparations were made at the end of the year to commence tapping.

The Mount Zion coconut plantation was looked after at a cost of \$133. Except where some unknown person fired the grass, the growth of the trees has been excellent.

The Government House Domain was looked after under a Committee consisting of Mr. W. H. LEE-WARNER and the Director of Gardens.

Revenue and Expenditure of the Committee of Management of the Botanic Gardens, Singapore, for the year 1915.

REVENUE.

	\$	c.	\$	c.
By balance in Bank on 1st January, 1915 ...	1,553	72		
„ Government Grant ...	12,376	00		
„ Sales of plants, seeds, excluding recoveries connected therewith ...	2,657	52		
„ Sale of rubber ...	4,104	69		
„ Advance payments in hand ...	303	53		
„ Bank-interest (\$59.62), recoveries, etc. ...	1,674	96		
			22,670	42

EXPENDITURE.

		\$	c.	\$	c.
By salaries and wages	...	11,943	31		
„ Other charges	...	7,949	85		
„ Balance in Bank on 31st December, 1915		2,777	26		
				<u>22,670</u>	42

**Government Grant and Expenditure on the Waterfall Gardens, Penang,
for the year 1915.**

GRANT.

		\$	c.	\$	c.
Grant	...	4,960	00		
				<u>4,960</u>	00

EXPENDITURE.

		\$	c.		
By salaries and wages	...	3,899	68		
„ Other charges	...	1,035	99		
Balance undrawn in the Treasury on December 31st, 1915	...	24	33		
				<u>4,960</u>	00

Revenue made by the Waterfall Gardens.

		\$	c.
And paid into the Treasury	...	833	75

**Revenue and Expenditure of the Committee for the Management
of the Government House Domain, for the year 1915.**

REVENUE.

		\$	c.	\$	c.
By balance in the Bank on January 1st, 1915		334	01		
„ Government grants	...	7,076	00		
„ the sale of rubber, grass, etc.	...	376	10		
„ bank interest (\$24.16), recoveries, etc....		79	00		
				<u>7,865</u>	11

EXPENDITURE.

By salaries and wages	...	5,923	77		
„ Other charges	...	1,545	10		
Balance in the Bank on December 31st, 1915		396	24		
				<u>7,865</u>	11

I. HENRY BURKILL,
Director of Gardens, S. S.

SINGAPORE, 15th March, 1916.

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS,

STRAITS SETTLEMENTS,

FOR THE YEAR

1916.

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1917.

Annual Report of the Director of Gardens, Straits Settlements, for the Year 1916.

The year 1916 was the fifth in succession of an unavoidably reduced European staff. In most ways its close left the Gardens in the same position as its beginning found them: the staff was changed only by the appointment of an additional Inspector of Coconut Trees for Malacca. Captain (now Major) T. F. CHIPP, the Assistant Director, was away throughout; and the search for Field Assistants was unproductive. The demand for plants and seeds was considerable; and thereby, with the sale of rubber, the revenue was maintained.

It is well to record what the short staff means. It means that the executive charge of one-third part of the Gardens has to be taken over by the Director as an addition to his administrative charge, displacing scientific and economic research.

It has meant since the commencement of 1912 the following distribution of the three executive charges:—

YEAR.	Botanic Gardens, Singapore, with Government House Domain.	Economic Gardens, Singapore, with the Goodwood and Mt. Zion Plantations.	Waterfall Gardens, Penang, with Roadside Trees.
1912	... The Assistant Curator, Mr. J. W. Anderson	The Acting Director, Mr. R. Derry.	The Overseer, Mr. Mohamed Haniff
1913	... Do.	The Director ...	Do.
1914	... The Director ...	The Acting Assistant Curator, Mr. J. Bradbery.	Do.
1915	... The Assistant Curator, Mr. J. W. Anderson	The Director ...	Do.
1916	... Do.	Do.	Do.
1917	... The Director ...	The Acting Assistant Director, Professor C. F. Baker.	Do.

The year 1916, as the table shows, was like the year 1913, the second of a cycle of three: for in 1912 and 1913, and in 1915 and 1916 the Botanic Gardens could be given the benefit of Mr. J. W. ANDERSON'S whole time: on the other hand in 1914 and again at the time of writing the Economic Garden is profiting by the whole time of an officer. This alternation has advantages under the circumstances.

The Committee of Management of the Gardens, Singapore, consisted of the Hon'ble Mr. A. M. POUNTNEY, the Hon'ble Mr. F. J. PIGOTT, Messrs. W. E. HOOPER, ST. V. B. DOWN, W. LOWTHER KEMP, and E. E. ADAMSON, together with the

Director of Gardens, until the end of June, when, on Mr. LOWTHER KEMP'S departure from the Colony, the Hon'ble Mr. H. W. FIRMSTONE was appointed in his place.

A Committee for the Management of the Waterfall Gardens, Penang, was created on September 22nd, consisting of the Hon'ble the Resident Councillor (Mr. A. T. BRYANT), Mr. LAWRIE C. BROWN and the Director of Gardens.

There was but the one change in the staff already referred to, namely, the appointment of a second Inspector of Coconut Trees for Malacca, responsible for the Alor Gajah Division, the senior Inspector being put in charge of the Central and Jasin Divisions.

Finance.

Except for provision to meet increments on salaries, and to meet the pay and travelling expenses of the Coconut Inspector at Alor Gajah, the budget votes for 1916 were the same as in 1915.

By the sale of plants, seeds, and by recoveries, etc., the Gardens' Committee, Singapore, realized \$8,154.60. By similar sales the Waterfall Gardens, Penang, realized \$627.09.

The position of the Gardens' Committee, Singapore, on January 1st, 1917, and on the same day of the preceeding four years, stood thus, cents omitted:—

	1914.	1915.	1916.	1917.
	\$	\$	\$	\$
In the Bank and in hand ...	3,123	1,553	2,777	3,247
Outstanding debts to the Gardens ...	426	366	439	634
Value of rubber in store ...	625	1,224	882	1,264
	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Making ...	4,174	3,143	4,098	5,145
Less advance payments ...	585	513	303	419
	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Total ...	3,589	2,630	3,795	4,726

The funds held on January 1st, 1917, comprised \$1,500 earmarked for the repair of the Javanese cooly lines so that the working balance was \$3,226.

An analysis of the sources of revenue gives the following table:—

	\$	c.
By the sale of economic plants and seeds ...	1,149	81
By the sale of ornamental plants and seeds ...	1,448	90
By the sale of rubber ...	3,367	37
	<u> </u>	<u> </u>
		5,966 08
By recoveries of the expenditure in connection with these sales, packing (\$355.66), cartage and coolies (\$164.60), freight (\$198.16) ...	718	42
By recoveries not connected with sales, and bank interest (\$57.40) ...	1,470	10
	<u> </u>	<u> </u>
		2,188 52
		<u> </u>
		\$8,154 60

The above statement is of utility as serving, upon comparison with the similar table in last year's report, to show in what measure (36 per cent) the revenue from ornamental plants has increased, while that from economic plants has decreased (28 per cent). From the two together the Gardens' revenue has slightly increased, for the increase on ornamental is greater than the decrease on economic plants; the revenue from rubber was \$800 less than in 1915, and the whole revenue less by the difference between \$5,966 and \$6,762. But \$4,105 having been the revenue from rubber in 1915, by deducting \$1,224 the value of the 1914 rubber sold in 1915, and adding \$882 the value of the 1915 rubber sold in 1916, the value of the rubber made in 1915 is

found to be \$3,763; and \$3,367 having been the revenue in 1916, by deducting \$882, the value of the 1915 rubber sold in 1916, and adding \$1,264 the value of the 1916 rubber sold in 1917, the value of the rubber made in 1916 is found to be \$3,749, or almost the same as in 1915. The difference in the Gardens' income is thus attributable to the conditions under which the rubber was sold.

The revenue made in Penang, which is almost all from ornamental plants, was increased by 3 per cent, \$629 against \$611.

As the Committee of Management for the Waterfall Gardens only came into existence late in the year, the \$399.76 made earlier was paid into the Treasury; but the \$227.33 made later was banked and is the Committee's opening balance for 1917.

Buildings.

At the turn of the Riding road in the Economic Gardens, Singapore, close to the plots where most of the experiments in food plants are being made, the Gardens' Committee built a fruit-store and a house for the Fruit-store keeper. The site was selected not only for the convenience of work, but that some protection against thefts might be obtained. Beyond this nothing more than petty repairs were executed, both in Singapore and in Penang.

Collections, Records and Investigations.

Acquisitions include plants and seeds from Messrs. LAWRIE C. BROWN, A. T. BRYANT, ST. V. B. DOWN, W. LOWTHER KEMP, J. C. PETER, F. O. RASMUSSEN, H. B. F. BARNARD, H. S. WHITESIDE and the Rev. Father COUVREUR; from Drs. N. ANNANDALE of Calcutta and N. P. PIERCE of Sta. Ana, California, Mr. H. N. RIDLEY, lately the Director, and Mr. L. G. REGNARD, Mauritius; the Royal Botanic Gardens, Kew, Calcutta, and Peradeniya; the Botanic Gardens, Hopetown, Jamaica, Trinidad, Hanoi and Buitenzorg; the Agri-Horticultural Society, Calcutta; from Lord BROUGHAM'S garden on the Riviera by the kindness of Lady SWETTENHAM; from the Departments of Agriculture, Egypt, Gold Coast, Nigeria, and Costa Rica; from the Bureaux of Agriculture, Washington and Manila; from the College of Agriculture, Los Banos, Philippine Islands; from the Forest Department of the Straits Settlements and Federated Malay States, the Deputy Conservator of Forests, Tavoy, and the Forestry Department, Formosa.

Roots of no less than 139 races of *Canna* were the gift of Father COUVREUR, which sooner or later will be available in quantity sufficient for bedding. Seeds of *Warszewiczia coccinea* were received for the second time from the Botanic Gardens, Trinidad, but the seedlings damped off as before: however, two well-grown plants were received later from the Buitenzorg Gardens, from which it is hoped to establish this beautiful plant. From Madagascar were received seeds of a *Spathodea*, which perhaps is *S. campanulata* only; but as *S. campanulata* never seeds in the Straits, new stock is valuable. One seedling was raised from Ceylon seed of the giant bamboo, *Dendrocalamus giganteus*, got in the hope that finer plants might be obtained than exist here. Seedlings of the palms *Wallichia disticha* and *Borassus flabelliformis* have been raised from seed kindly supplied by the Royal Botanic Gardens, Calcutta, and of *Phoenix Roebelinii* from seed sent by M. HAUTEFEUILLE of the Botanic Gardens, Hanoi.

Cupressus glabra, raised from seed sent to Singapore by the Bureau of Agriculture, Washington, appears to be a very useful acquisition: a dozen plants of it are at present growing well in pots.

Mr. G. E. S. CUBITT, Conservator of Forests, and his officers, in prosecution of the investigation on Dipterocarps and other forest trees, named in last year's report, supplied 98 samples of seed, which were all sown, and the seedlings studied. Two papers of results have already appeared in the Journal of the Straits Branch of the Royal Asiatic Society.

Just outside the limits of the Gardens occurs the only known tree of *Shorea gibbosa*. The opportunity of its fruiting was taken to raise seedlings which are being established in the Gardens. Near the *Shorea* stands the only tree in Singapore of *Ormosia macrodisca*, which unfortunately is going to pieces without leaving any seedlings of its kind.

Seedlings of *Bombax insigne* have been raised from Tavoy seed, and of *Bombax malabaricum* from Calcutta seed. It has been of interest to notice their stems swollen as in the Baobab.

The Director of the Royal Botanic Gardens, Kew, was so good as to obtain for the Gardens seed of two kinds of Quebracho, both of which are growing satisfactorily. It is curious that this tan-bark tree had not been introduced earlier.

Many Australian Eucalypti, Acacias and Casuarinas have been tried, with the exception of *Eucalyptus robusta* and *botryoides* disappointingly.

Dr. P. S. CRAMER, Chief of the Plant-breeding Station, Buitenzorg, was so kind as to send some selected rubber seed, from which seedlings were raised, now planted out in Block 15 of the Economic Garden.

Two or three races of the Roselle were grown from Philippine seed and fruited fairly well. *Basella alba*, the Poi spinach, was grown satisfactorily. Several races of beans from Buitenzorg were grown.

By the good offices of Mr. H. S. WHITESIDE, a particularly large Rambutan has been introduced into the Gardens from the neighbourhood of Port Dickson: and he also supplied seed of the Carounda, from which a new stock of seedlings has been raised. Mrs. G. P. OWEN supplied seed of an excellent free-stone Rambutan.

The Bureau of Agriculture, Manila, supplied plants of *Carissa Arduina*, seed of an edible *Calamus* called Litoco, *Genipa americana*, *Cecropia palmata*, *Aegle Marmelos*, several races of Pineapples, and some other fruit trees.

Through the Director of the Royal Botanic Gardens, Kew, 31 races of four species of yams were obtained from the Gold Coast and Nigeria. These gave a small crop at the end of the year, from which they were replanted. Tubers of a Hainan yam were presented by Mr. G. P. OWEN, and are being grown. The yams obtained in 1913, 1914 and 1915 were studied and reported on in the "Gardens' Bulletin," with nine plates in illustration.

Mr. MOHAMED HANIFF, in the Waterfall Gardens, Penang, raised by crossing several hybrids of *Hibiscus*.

By co-operation with the Bureau of Agriculture, Washington, an experiment was done on the packing for long transit by post of mangosteen seeds. Mr. FAIRCHILD, of the Bureau, thinks that the conditions under which the mail bags are kept on board ship, determine whether the seeds shall live or die much more than the packing.

Library.—The Gardens obtained from the Jail the maximum amount of binding that the Jail could give, namely of 84 books. Outside were bound 79.

For the gift of books the Gardens are indebted to His Highness the Prince BONAPARTE, Mr. J. S. GAMBLE, Messrs. SANDER & SONS, the United States Bureau of Agriculture, the University of Leiden, Mr. W. S. MILLARD of Bombay, and the Government of Formosa. Exchanges of publications have been maintained as far as possible.

Bulletin.—Only one number of the "Gardens' Bulletin" could be issued. It contains a report on Locusts in Malacca, notes on Orchids, Rainfall statistics, etc. The Gardens' rainfall records have proved useful in helping towards an understanding of the conditions under which certain orchids flower.

Correspondence.—1,758 letters were received, and 2,121 despatches are recorded. Research material was supplied to Professor F. O. BOWER, of the University of Glasgow, the late Professor H. H. W. PEARSON of the South African College, the United States Bureau of Agriculture, and M. E. COLLIN of the Laboratory of Pharmacy in the University of Paris.

Herbarium.—Plant mounting was stopped as the supply of mounting paper ran out. This entails little difficulty, for the present Plant collector is now trained sufficiently to undertake the extensive arranging of specimens required, and he was put onto that work.

A collector was sent to the Siamese Malay States with Dr. N. ANNANDALE in January, and brought back interesting material. No botanising has been possible for the Director except when out coconut inspecting in Malacca, and Penang.

Three bundles of dried plants collected on Gunong Kerbau by Mr. H. C. ROBINSON, and a few other specimens were received from the Royal Botanic Gardens, Kew, and also some bundles from the Bureau of Science, Manila. The following specimens were sent out:—

- 254 to the Royal Botanic Gardens, Kew,
- 33 to the British Museum of Natural History, S. Kensington,
- 189 to the Royal Botanic Gardens, Calcutta,
- 51 to the Botanic Gardens, Buitenzorg,
- 234 to the Bureau of Science, Manila,
- 48 to Mr. OAKES AMES, Harvard University, Cambridge, Mass.

Several Myxomycetes were sent to Miss G. LISTER and Mosses to Mr. N. DIXON, who were so good as to determine them. Mr. A. SHARPLES of the Department of Agriculture, Federated Malay States, also named some fungi.

Hand specimens of timbers cut from trees which had grown in the Gardens, were sent to Kew, Manila, Dehra Dun and Buitenzorg. A set of similar specimens was received back from Manila.

Six pairs of almyrahs for specimens were made in the Gardens and placed in the Herbarium.

Mr. H. N. RIDLEY is preparing a Flora of the Malay Peninsula, south of Lat. 7° N.; and in sending herbarium material to Kew the attempt is made to do all that can help him.

Botanic Gardens.

(AREA 80 ACRES, 2 ROADS, 3 PERCHES).

The dry weather in January and February favoured several plants whose flowering was exceptional. Among them were the orchid *Stauroopsis breviscapa*, and some Browneas. Shoreas flowered in the Gardens jungle and elsewhere (see the "Journal of the Straits Branch of the Royal Asiatic Society 1917," pp. 43 and 161). The mangos on the Lake margin produced so much blossom that seven million flowers were estimated to be on one tree, one per mille of which set fruit.

The dry weather also favoured pests, so that in March, the caterpillar of *Catopsilia crocale* badly defoliated trees of *Cassia fistula* and *C. siamea*, while that of *Oxyodes scrobiculata* damaged Rambutans and *Filodes fulvidorsalis* damaged *Thunbergia grandiflora*. The first named is a butterfly, the second and third are moths. Handpicking was resorted to, and as regards the first it was ascertained that fowls devour them greedily, so that their numbers would appear to have been due to multiplication in excess of what the birds of the Gardens could keep down.

The Coccid, *Orthezia insignis*, was troublesome on *Barleria cristata*, *Thunbergia erecta*, *Randia Mussaenda*, and *Wulffia stenoglossa*. Another Coccid, *Tachardia aurantiaca*, which is common on Acacias, was noticed to affect *Ficus irregularis* badly.

Two diseased areas appeared in the Gardens jungle. Rather large trees died and then the undergrowth died too. This phenomenon is not new: it was recorded by Mr. RIDLEY in the "Agricultural Bulletin of the Malay Peninsula", 1900, p. 257, and the fungus causing it was described by Mr. MASSEE as *Rosellinia echinata* ("Kew Bulletin" 1901, p. 155). The diseased areas were treated as advised for *Rosellinia radiciperda* namely, by liming after burning the dead wood.

In the centre of each infected patch the fern *Nephrolepis acuta* appeared, apparently as a response to the admission of light in sufficient quantity, as it is absent from the surrounding forest. Foresters in Malaya might do well to observe and make notes on such pockets of dying trees.

Randia Mussaenda has been bedded out on the Bandstand hill: it has a delightful fragrance as of orange blossom. *Ficus irregularis*, one of the most beautiful of the Figs has been propagated successfully for the first time in the Gardens, and is being planted out in new places. *Diospyros Ebenum*, the Ceylon Ebony, reported formerly as a failure, has also been planted out and appears of promise.

Areca glandiformis fruited and seedlings have been raised.

The tree referred to as "*Acer heterophylla*" in the Gardens Report for 1914, on further cultivation proves to be *Aleurites cordata*. The tree of *Gustavia speciosa* mentioned in the Report for 1912 as destroyed is now re-established from root suckers.

The reshaping of the Dell in the Gardens was completed in 1916, but the water supply system remained unfinished. The Dell is one of the prettiest spots in the Gardens.

One of the Snake-eating eagles which used to visit the Gardens was shot in the neighbourhood. It was mischief merely to shoot the bird: and such acts strike directly at the interest of the Gardens.

Naval or Military bands played in the Gardens on seven occasions.

4,619 ornamental plants were sent out, and

201 packets of seed.

Plants were supplied free to the garden of the Wireless Station and to the General Hospital.

Economic Gardens.

(AREA 100 ACRES, 1 ROOD, 31 PERCHES).

In the report for 1915, information was given on the allocation of an area for fruit trees: in 1916, the terracing of this area was proceeded with as labour could be spared, but it was not completed.

Replacements were made throughout the rubber blocks, and diagonal drains cut through Block 5 for the isolation of the trees attacked by *Fomes semitostus*. In doing this several *Casuarinas* intermixed with the rubber were removed.

A small amount of damage was done by the caterpillar of *Papilio polytes* to orange seedlings. The bug *Aphanocnemis phasiana* was found on *Cajanus indicus*,—a plant which it attacks in Southern India.

Thieves were worse than any other pest. The thefts of yams recurred so often, always on Saturdays or Sundays, that a watchman had to be detailed to guard against them. There were also thefts of other produce, probably by Gardens' coolies. Two Chinese house-thieves were caught and went to jail.

Several pineapples were raised weighing above 12 lbs.

In August, the Director addressed the Malacca Planters' Association on the subject of the selection of rubber trees, and obtained the promise of assistance from several gentlemen who were present at the meeting. The *modus operandi* is to plant the selected Gardens' stock out as stumps on the estates in places where it can have a fair trial, and always open to examination.

Latex was supplied to three experimenters, and rubber seed for experiment to a large firm of soap-makers. An exhibit illustrating the tapping of *Hevea* and the latex of *Hevea* and *Dyera* was supplied for exhibition in the United States.

4,075 lbs. of rubber were made,

324,960 seeds of *Hevea brasiliensis* sold,

4,000 seedlings of *Hevea brasiliensis* sold,

330 packets of economic seeds sent out,

937 economic plants other than *Hevea* sent out.

The rubber seed crop was one of the largest that has been recorded. The seed-fall occurred quite abnormally.

Waterfall Gardens, Penang.

(AREA 79 ACRES, 1 ROOD, 7 PERCHES).

The water-supply system was cleaned and extended to the Fern Rockery, where rough granite steps were made and the beautiful *Cyrtodera fulgens* planted widely. The bank of the stream below the central bridge was cleared, smoothed and turfed. Considerable metalling was done to the roads. It is noticed that motorists use the Gardens' roads for testing their engines, a purpose for which they are not made; and it may become necessary to close the steeper ones to them.

A collection of Burmese orchids was obtained. Mr. C. S. MAY was so good as to give seed of *Strophanthus*, and Mr. LAWRIE C. BROWN seed of *Thespesia* and of other plants.

The beetle, *Acythopeus aterrimus*, was identified as damaging orchids, notably *Phalaenopsis esmeralda*, *Vanda teres*, *V. Hookeri*, *Cypripedium niveum* and *Rhynchostylis retusa*, by Dr. G. A. K. MARSHALL of the Imperial Bureau of Entomology.

The last plants of *Kokia Rockii* and *Widdringtonia Whytei* (Mlanji Cedar) died. When supplying the seed of the latter in 1913, Mr. E. W. DAVY, Chief Forest Officer of the Nyasaland Protectorate, stated that it rarely thrives at Zomba for more than 10-12 years: but it was hoped that the more uniform climate of the Malay Peninsula might offer it more suitable conditions. It will be tried again.

The sprawling Lankawi bamboo, *Schizostachyum elegans*, flowered and died, but first furnished material from which Mr. RIDLEY described it. The handsome *Mono-horia* introduced in 1915 is not doing well. The Ipoh tree *Antiaris toxicaria* was found to exist in the neighbourhood of the Gardens lines.

One hundred and sixty-eight orders were met.

Other Charges.

Coconut Inspection.—The cutting down of scattered coconut palms in rubber has been considerable and in some places very extensive removals of coconut palms have occurred. This vogue adds greatly to the work of the coconut inspectors: and to meet the need Malacca was divided into two charges, the one charge of two divisions, Central and Jasin, the other of the Alor Gajah Division, each under an Inspector. These Inspectors drawing wages rising to \$30 per mensem can hardly be expected to enforce the Act against the larger corporations, and a considerable amount of stiffening is required at the present, to give which the Director spent as much time as he could spare in the field in Malacca.

On one of the visits, it was discovered that the wasp *Scolia erratica* parasitises the Red Coconut Weevil.

The work demanded of the two Malacca Inspectors differs considerably, for in the North-west of the Territory dying Kabong palms are common, remains of the old Kabong sugar industry, and the Alor Gajah Inspector has to devote a large part of his time to getting them destroyed. He has to deal with villagers' small holdings in a greater measure than the senior Inspector in whose wider charge are very extensive Company holdings under rubber, and also wide forests. This is why the one has a single division, but the other two.

In Singapore Island two considerable estates removed coconut palms from among rubber, whereof one estate gave the department a great deal of trouble by only half carrying out orders.

In Singapore, 475 notices were served relating to 574 dead palms, 1,495 felled trunks, and 127 heaps of rubbish. Thirty-five palms were removed departmentally as the owners could not be found, or because the trees stood on Government land.

Goodwood Estate Rubber Plantation (area 7 acres, 1 rood, and 26 perches). The Goodwood Estate rubber land was drained by the Public Works Department. So long as the drainage operations were in progress it was not worth while to spend much money on cultivation, and expenditure was so reduced that the cost of the plantation was only \$345.58. Tapping was commenced and revenue to the amount of \$121.09 paid into the Treasury.

Mount Zion Coconut Plantation (area approximately 24 acres). This plantation was looked after for the Rural Board at a cost of \$158.51. The first planted six and two-fifths acres was let out: and planting continued on the newly filled-in ground. It has to be recorded that the first plantings were done with mixed coconuts: but that in the later plantings three rows of each of the following races have been put in,—Klapa nipa, Klapa jantong, Klapa sepong, Klapa ijau, six rows of Klapa sekol, and 2 groups of King coconuts; the rest is being filled with Klapa besar. The planting distance is 20 by 20 feet.

Government House Domain (Committee's area approximately 98 acres). When Mr. W. H. LEE-WARNER left the Colony, Mr. M. E. SHERWOOD took his place on the Committee for the management of the Government House Domain. Certain small savings were possible in the expenditure which have caused the Committee's balance in hand to be slightly increased.

Locust destruction in Malacca was handed over to the Agricultural Department of the Federated Malay States. But an experiment, started in connection with it, upon the utilising of *Leucaena glauca* for the re-forestation of lallang wastes which may be regarded as the strongholds of the locusts, is being continued by the Department. The idea is to find conditions under which the *Leucaena* can be got to spring up through the grass with such vigour as to serve for a nurse to bigger growth, upon the establishment of which it can be turned to account as fuel.

Revenue and Expenditure of the Gardens Committee.

REVENUE.

	\$	c.
By balance in the Bank on January 1st, 1916	2,777	26
„ Government grant	12,376	00
„ sales of plants, and recoveries of costs connected therewith	2,598	71
„ the sale of rubber	3,367	37
„ advance payments	558	38
„ Bank interest (\$57.40), and recoveries, etc.	2,188	52
	23,866	24

EXPENDITURE.

		\$	c.
By salaries and wages	...	12,418	49
„ other charges	...	8,200	62
„ Balance in the Bank on December 31st, 1916	...	3,247	13
		<u>23,866</u>	24

**Government Grant, and Expenditure on the Waterfall Gardens, Penang,
with the revenue of the Committee of Management.**

		\$	c.
Grant	...	4,960	00

		\$	c.
By salaries and wages	...	3,825	80
„ other charges	...	1,133	37
Balance undrawn from the Treasury	...	0	83
		<u>4,960</u>	00

REVENUE.

		\$	c.
Made by the Gardens and paid into the Treasury	...	399	76
Banked by the Committee of Management	...	227	33
		<u>627</u>	09

**Revenue and Expenditure of the Committee for the Management
of the Government House Domain.**

REVENUE.

		\$	c.
By balance in the Bank on January 1st, 1916	...	396	24
„ Government grants	...	7,076	00
„ sales	...	60	00
„ Bank interest (\$21.52) and recoveries	...	277	57
		<u>7,809</u>	81

EXPENDITURE.

		\$	c.
By salaries and wages	...	5,795	28
„ other charges	...	1,316	63
Balance in the Bank on December 31st, 1916	...	697	90
		<u>7,809</u>	81

I. HENRY BURKILL,
Director of Gardens, S. S.

SINGAPORE, 15th October, 1917.

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS,

STRAITS SETTLEMENTS,

FOR THE YEAR

1917.

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1918.

Annual Report of the Director of Gardens, Straits Settlements, for the Year 1917.

The Committees of Management for the several parts of the Department were composed as follows:—

(1) *Gardens Committee, Singapore*.—The Hon'ble Mr. A. M. POUNTNEY (until December 13th), the Hon'ble Mr. F. J. PIGOTT, the Hon'ble Mr. H. W. FIRMSTONE, the Hon'ble Mr. F. M. ELLIOT (from October 27th), Messrs. W. E. HOOPER, St. V. B. DOWN and (until October 29th) E. E. ADAMSON, with the Director of Gardens: (2) the *Committee for the Waterfall Gardens, Penang*, the Hon'ble Mr. A. T. BRYANT (until February 25th), the Hon'ble Mr. W. PEEL (from February 25th to September 28th), the Hon'ble Mr. W. C. MICHELL (from September 28th), and Mr. LAWRIE C. BROWN, with the Director of Gardens: and (3) the *Committee for the Government House Domain*, Mr. M. E. SHERWOOD with the Director of Gardens. The writer was Director throughout the year.

The year was full of difficulties on account of want of superior staff, and on account of the increasing demands of labour and of rising prices.

Mr. J. W. ANDERSON, Assistant Curator, left the service of Government on January 12th to take up planting. Major T. F. CHIPP, the Assistant Director, being on military duty, the Director was left without either of his European Assistants: and as intermediate staff (the clerk alone excepted) does not exist in the Singapore Gardens, the duties of both posts devolved almost entirely upon the Director. The war, which had robbed the Gardens of the services of Major CHIPP, had made it impossible to replace Mr. ANDERSON: and recourse was necessary to temporary measures. In these it was the Department's good fortune to obtain the service of Professor C. F. BAKER to act as Assistant Director during a period of leave from the University of the Philippines. Professor BAKER arrived on June 22nd, but he was recalled on December 12th. In the second place Mr. E. H. MATHIEU was appointed an Extra Assistant Curator from December 10th.

As to intermediate staff, the new rate of pay offered for Field Assistants has drawn applications from suitable men; and the addition to the Department of an extra officer in one of the two posts is likely to take place early. Mr. MOHAMED HANIFF, formerly Overseer of the Waterfall Gardens, Penang, has been appointed to the other, and a Foreman-Gardener engaged from part of the saving thus effected.

In the subordinate staff there were many changes. Mr. M. G. EZEKIEL, Foreman-Gardener at Government House, resigned in April.

The titles of the subordinate staff employed in Penang were changed so as to make a simple salary scheme cover the whole Department.

Labour, especially Javanese labour, demanded increasing wages. It was imperative to resist this demand as much as possible, because the finances available would not allow of the maintenance of concessions: but finally wages had to be raised in every section of the Department. Each section presented a different problem, even the contiguous Botanic and Economic Gardens, Singapore, differing. The Botanic Garden suffered most from the situation. From towards the end of 1916 its force had become difficult to keep together, and through the first half of 1917 grew gradually less and less. Had there been adequate cooly lines, the Javanese leaving might have been replaced by Tamil labour, but adequate lines do not exist; and in want of them

other expedients had to be tried. First of all, in April all the women living in lines and willing to work were engaged, a measure retaining to some degree the husbands. Then in May the pay of the gardeners, as contrasted with the coolies, was raised, lest the best men should be lost. Next, from June 1st a Rice Allowance had to be added to the pay of all, making it about 10 per cent better; and finally from October 1st, a further 5 per cent had to be conceded.

The Tamil labour of the Economic Garden, which largely houses itself in the Bukit Timah Road, showed its tendency to leave the Department only in February; and from then to June, when the Rice Allowance was conceded, the force gradually decreased in size and efficiency. From June onwards the competition of rubber estates near to the Garden several times drew off labour, but the average number retained was fair.

On the Government House Domain, where the housing is good, and where proximity to the town is an inducement to engage, it was only necessary to concede Rice (or War) Allowance from October 1st. In the Waterfall Gardens, Penang, where the scale of pay had been revised towards the end of 1916, and where the Tamil labour is well housed, a 10 per cent increase from November 1st sufficed.

The changing prices of stores made work: and two contracts were so badly met that they had to be cancelled. Of manure it was never possible to obtain enough.

Finance.

The grants by Government for 1917 contained nothing essentially different from those for 1916 except an increase of about \$1,300 for the salaries of the Field Assistants, and of this \$300 has been saved by the employment of a Foreman-Gardener *vice* Overseer, as mentioned above.

There were considerable savings by reason of undrawn salaries.

A. *Singapore Gardens*.—The position of the Gardens Committee on January 1st, 1918, and on the first day of the three preceding years was as follows:—

	1915.	1916.	1917.	1918.
	\$	\$	\$	\$
In the Bank and in hand ...	1,553	2,777	3,247	1,162
Outstanding debts to the Gardens ...	366	439	634	327
Value of rubber in hand ...	1,224	882	1,264	2,299
making ...	3,143	4,098	5,145	3,788
less payments in advance ...	513	303	419	574
Total ...	2,630	3,795	4,726	3,214

An analysis of the sources of the revenue furnishes the following table:—

	\$	c.
By the sale of ornamental plants and seeds ...	781	37
By the sale of economic plants and seeds ...	886	90
By the sale of rubber ...	2,631	00
		4,299 27
By recoveries of expenditure in connection with sales, <i>e.g.</i> , packing (\$298.77), cartage and coolies (\$132.12), freight (\$167.76) ...	598	65
By recoveries not connected with sales ...	1,594	03
		2,192 68
Total ...	\$6,491	95

Of the revenue, \$1,264 was derived from rubber in store on December 31st, 1916. Deducting this from the receipts by rubber and adding the value of that which was in store on the same day of 1917, the value of the rubber made in 1917 is found to be \$3,666.

Neither in rubber, nor in the sale of ornamental plants, nor in the sale of economic plants and seeds was the estimated revenue attained: for although more rubber was made than in any previous year, the fall of the market prevented attainment, and

although orders were received for rubber seed to the value of \$1,280, there was a grudging crop which yielded only \$471, thus curtailing the revenue from economic plants and seeds; and in the third place the public asked for fewer ornamental plants, than in the preceeding years. The net revenue was \$1,667 short of that obtained in 1916, and \$2,463 short of that obtained in 1915.

Three facts may be stated here: (1) that the Open vote for the upkeep of the Botanic Garden has not differed by much from \$8,000 for thirty years, the additional expenditure upon it being met by the revenue from the Economic Garden; (2) that prices have been enhanced greatly during these years, but in the Rubber boom when this in the first instance markedly took place the Gardens were carried on the crest of the wave of prosperity by the high price of their rubber and by their partial monopoly of rubber seed; (3) that since then the value of rubber and rubber seed has fallen while prices have risen further, latterly rapidly, causing the revenue, which in 1911 and in 1912 covered 57 per cent of the whole of the Committee's expenses, from 1913 forwards to cover only 39 to 47 per cent. The result has been that less and less money has been available for labour in proportion to the combination of rising prices and falling revenue; the labour, for instance, employed in the Botanic Garden in the last four years, *i. e.*, from 1914 forward, has cost successively \$6,392, \$5,428, \$5,163, and \$5,079.

B. *Waterfall Gardens, Penang.*—The position of the new Committee of Management for the Waterfall Gardens on January 1st, 1918, was

in the Bank and in hand.....	\$1,397 36
outstanding debts.....	35 90
Total ...	<u>\$1,433 26</u>

The revenue realised during 1917 from the sale of plants—almost all ornamental—was \$1,125.62, being an increase of 80 per cent, and largely due to Mr. LAWRIE C. BROWN'S enthusiastic advocacy of gardening.

The Government grant met the wage bill and half of the expenditure on tools and various services; the Committee's funds met the rest.

Buildings.

Singapore.—The building of quarters for fourteen married Javanese was to have been commenced; but it so fell out that no contracts could be closed. The building of the Field Assistant's quarters was also to have been done and was not commenced for the same reason. The roof of the large Plant House went unrepaired from want of funds.

The Gardens Committee at a cost of \$1,200 repaired the central building of the Javanese lines, and with the old iron bear cages constructed an orchid-house for such species as need more air than the propagating yard affords.

The upper tank in the Dell gave way and was repaired.

Penang.—Petty repairs only were asked for.

Collections, Records and Investigations.

Acquisitions include plants or seeds by gift or exchange from—Mrs. R. H. ADAMS, Messrs. A. AGNEW and J. W. ANDERSON, Professor C. F. BAKER, Mr. LAWRIE C. BROWN, Miss A. M. BURKILL, Mrs. H. B. DODDS, Mr. St. V. B. DOWN, the Hon'ble Mr. F. M. ELLIOT, Messrs. R. J. FARRER, W. HARRIS, W. E. HOOPER, J. S. ISAAC, V. LUNBERG, T. R. MANUS, C. G. MAY, E. D. MERRILL, W. S. MILLARD, G. P. OWEN, F. O. POPENOE, L. G. REGNARD, and H. N. RIDLEY, Professor J. F. ROCK, Messrs. B. K. SAHEB, G. C. VALPY, and J. B. van WAVERER, H. H. the Lieutenant Governor of Papua, the Royal Botanic Gardens, Kew, Calcutta, and Peradeniya, the Botanic Gardens, Buitenzorg, the Zoological Gardens, Perth, W. Australia, through the Hon'ble Mr. W. KINGSMILL, the Departments of Agriculture, Federated Malay States, India, Egypt, United States of America, and Costa Rica, the Superintendent of Public Gardens, Jamaica, the College of Agriculture, Los Baños, Philippine Islands, Messrs. BARR & SONS and Messrs. DREER & Co. The number of plants and seeds received from all sources in Singapore was 4,307 plants and 975 packets of seeds, and in Penang 715 plants and 130 packets of seeds.

The palm collections which are under revision, have been enriched by the addition of seedlings of *Hyphaene indica*, the branched Indian palm, and of the Date, and by seeds of other species.

Mr. V. LUNBERG when leaving Singapore generously gave material of all the races of *Hibiscus* that he had collected. Mrs. R. H. ADAMS and Mr. W. E. HOOPER have added to the *Canna* collection. Messrs. J. B. van WAVERER and A. AGNEW have given orchids. A few orchids from northern Sumatra, and from the Kedah Islands were purchased: the visit which Mr. MOHAMED HANIFF paid to Takowa-pa in the Siamese Malay States added a large number to the collection in the Waterfall Gardens. Another expedition made by Mr. HANIFF, namely, to the Taiping hills, enabled him to obtain from the Hill Gardens *Maurandya barclayana* which is doing very well in Penang, and *Montanoa bipinnatifida* which promises well.

In the Waterfall Gardens an interesting sport has appeared: it is an *Acalypha* and somewhat ornamental.

Three distinct varieties of the Avocado pear have been obtained, one being that which the Department of Agriculture has in Kuala Lumpur, the second from Ceylon, through the kindness of Mrs. H. B. DODDS, and the other from California. The Avocado pear is a very valuable tree for the Malay peninsula, where it bears freely; one specimen tree in the Gardens in 1917 yielded nearly 400 lbs. of fruit.

Indigos have been got from Buitenzorg, Behar and Kelantan. Mr. R. J. FARRER who supplied the Kelantan seed, sent also *Strobilanthes flaccidifolius*. The indigo grown in Kelantan is *Indigofera Anil*, an essentially Indo-Chinese culture, as also is the *Strobilanthes*.

An interesting *Solanum* has been received from Egypt. It possesses in the climate of Singapore characters which if rightly blended with those of the Trong or Brinjal would be most useful; and it will be cultivated further in the hope of raising hybrids.

The Royal Botanic Gardens, Kew, supplied seed of a new tree cotton, and an edible Bromeliad. His Honour the Lieutenant-Governor of Papua was so good as to cause Papuan yams to be sent. A long series of vegetable seeds was obtained by exchange from the College of Agriculture, Los Banos, Philippine Islands.

Special Investigations.—The Director continued his experiments with yams, and wrote a report published in the Gardens Bulletin on this work to the end of 1916. He contributed a paper on food crops to the First Agricultural Conference in Kuala Lumpur.

Professor C. F. BAKER, while Assistant Director, made large collections of injurious insects and plant pests, from the gradual working out of which most valuable information will be got. He also carried out a series of trials with vegetables upon which a report will be issued.

Dr. E. E. GREEN has continued to give his kind services in the naming of Coccids.

Pests.—The following came under notice (1) the large *Rhynchophorus* beetle which was known to destroy *Pinanga* palms destroyed a *Rhopaloblaste*, (2) the moth, *Cosmophila erosa* damaged *Hibiscus* plants considerably, and (3) a moth of the genus *Euchromia* was very troublesome on ornamental *Ipomoeas*. Dr. HANITSCH was so good as to determine these pests.

Library.—No books were bound: there was never time to prepare them for binding. The usual exchanges were carried on. The Government of France presented a copy of *La Science Française*, a work prepared for the San Francisco Exposition; the Government of Indo-China a copy of MM. CREVOST & LEMARIE'S *Catalogue des Produits de l'Indo-Chine*, Vol. I. and that of the Dutch Indies a copy of M. HEYNE'S *Nuttige Planten van Nederlandsch-Indie*, in four volumes. The two last-named works should be well known in Singapore. Miss L. GIBBS very kindly gave a copy of her *Contribution to the Flora of the Arfak Mountains, New Guinea*, and Professor J. F. ROCK a copy of his *Ornamental Trees of Hawaii*.

Bulletin.—One double part was all of the "Bulletin" that could be issued. It is impossible under the present circumstances to make it the Quarterly which it was intended to be.

Herbarium.—The re-arranging of the collections has been continued, mounting being suspended. The Director had hardly any opportunities for botanising: but a plant collector was sent with Mr. MOHAMED HANIFF on both of his expeditions. The following were received:—178 specimens from the Royal Botanic Gardens, Kew; 367 from the Bureau of Science, Manila; 671 from Professor C. F. BAKER; 7 from Mr. A. P. VESTERDAL; and 40 from Mr. J. R. WEIR, Forest Pathologist in the United States Department of Agriculture. Also several hundred specimens were received for determination from the Forest Department.

Specimens are not distributed in return to Europe at present, but retained in Singapore, unless there is some special reason for at once forwarding them, such as Mr. RIDLEY'S work upon the Malayan Flora.

The following were sent out:—

- 40 to the Royal Botanic Gardens, Kew,
- 272 to the Royal Botanic Gardens, Calcutta,
- 362 to the Bureau of Science, Manila,
- 176 to the Botanic Gardens, Buitenzorg,
- 30 (being Mosses) to Mr. H. N. DIXON, Northampton,
- 9 (being parasitic plants) to the United States Laboratory of Forest Pathology, Missoula, Montana.

Mr. DIXON was so good as to return determinations; and Miss G. LISTER has continued her kindness in determining Myxomycetes.

Botanic Garden, Singapore.

The year 1917 was unusually wet: the rainfall recorded was 109.18 inches with only 98 rainless days, against 133 days in 1916, 125 in 1915 and 158 in 1914. The Gardens' lake overflowed several times.

The precipitations of the North-east monsoon never ceased, and consequently those plants which need the dry weeks of February for laying down buds, flowered badly.

The beds and roads needed constant weeding: and the lawns more mowing than could be given.

The Pigeon orchid (*Dendrobium crumenatum*) flowered on no less than nineteen days, the frequent rainstorms suiting it.

Several trees were lost. The only tree of *Eucalyptus pulverulenta* died in March from white ants. Three *Rhodamnia* trees fell at the end of the year, rotten at the roots. Two big *Cananga* trees were killed by lightning in August, and a group of trees was also killed in the Gardens' jungle.

A *Ficus benamina* was partly destroyed in November by wind but after having been weakened in consequence of a careless cooly on the road outside the Gardens setting fire to the vegetation in its forks.

The handsome screens of *Thunbergia laurifolia* near the Liane Road had to be cut down as they were destroying their supporting trees.

For bedding Cannas were very largely resorted to, and on the Bandstand hill annuals from European seed. *Spathoglottis plicata* served for a border along the front of the large Plant House for half of the year, the position supplying the right conditions. Crotons in a numbered series were set out on the Hill, and preparations made to treat the *Hibiscus* collection similarly. Unless such collections have permanent places, the losses are considerable. The better to give the pot plants in the propagating yard fixed places, three new cinder tables have been made and three more are being made.

A Chinese gardener was employed throughout the year raising annuals, and succeeded beyond expectation with *Antirrhinums* from Messrs. Barr & Sons, and with *Lobelia erecta*. Unfortunately he left at the end of the year.

Dipladenia Harrisii fruited for the first time; *Arenga undulatifolia* flowered, and *Kigelia pinnata*.

Roads were extensively and well repaired by the Public Works Department.

Naval or Military bands played in the Gardens on six occasions.

Palms were given free to the Raffles Museum, and a hedge of *Duranta* to the Union Jack Club. The number of plants sent out was 4,635 and of seeds 248 packets.

Labour was thus utilised:—for pot-plants at the rate of 8.84 men per diem, for cleaning roads 6.47, for lawns 6.61, for bedding 3.91, for nurseries 3.04, for sweeping 2.65, for caring for the trees 1.83, for rockeries 1.11, for cleaning the lake 0.78, and unclassified 1.80.

Economic Garden.

No planter can cultivate food crops without suffering from larceny: it is a curse common to the East and West Indies, which limits the planters' operations: and in the Economic Garden as the attention to food plants has increased, so has the trouble from pilfering fingers which scratch under the arrowroot plants for ripe tubers, take ripe fruit of which the seed is wanted, and now particularly steal yams. In 1917 there were yam thefts on six occasions, thefts of Indian corn, of durian fruits, of ginger (the whole stock), of pineapples, and of other produce such as plantain leaves, done by day and by night, on week-days, but especially on Sundays. How is it possible to ascertain the yield of crops when these thefts recur? A guard costing \$200 per annum has had to be instituted against them.

Rubber tree No. 27 fruited for the first time since it was marked down and put out of tapping for selection. Its seeds were carefully collected, and have given a supply of seedlings. Tree No. 610 has not fruited yet. These with No. 1267, newly selected, appear to be the three trees of most promise.

Tree No. 1844 on the other hand has been marked down for removal. It is believed not to be *Hevea brasiliensis*, but some allied species of inferior worth which might conceivably pollinate the good trees and so deteriorate their seed. It gave a few seeds in 1917; and four seedlings have been raised. When it is seen that these are established, the mature and now flowering tree will be removed from among the good rubber trees.

A public trial of the Ilcken-Down process of preparing rubber was made between October 24th and 31st, with the result that the process gave five per cent more rubber by weight than the acetic acid method as practised in the Gardens. The chemical value of the rubber has not been ascertained yet.

Remarkable success was achieved with a race of the Rozelle from the Philippine Islands. It grew 6—8 feet high and bore freely.

In January, the Singapore Cold Storage Company sent to the Gardens for trial a sack of locally made bone meal. It was applied to rubber seedlings and had a good effect temporarily: and it was also applied to yams, the result being a gain of 18 per cent in one race, a second and control experiment being rendered useless by thefts.

Caryocar nuciferum, the Butter nut, fruited for the first time. *Pentadesma butyracea*, the Tallow tree, bore very heavily, but it was most difficult to preserve the seeds from squirrels.

5,708 pounds of rubber were made,
100,628 seeds of *Hevea brasiliensis* sent out, and
11,050 seedlings of *Hevea brasiliensis*,
29 packets of seeds other than *Hevea*, and
2,539 economic plants in pots.

Labour was utilised as follows:—for rubber-tapping and preparing at the rate of 9.05 men per diem, for cultivation 8.13, for the grassy slopes 6.68, for pot-plants 2.10, in nurseries 1.68, in seed-collecting 1.53, on trees 2.04, for sweeping 0.69, on roads 0.85, and unclassified 0.80. The labour put into rubber-making, including cultivating, cost \$1,978.

Waterfall Gardens, Penang.

The rainfall in the Waterfall Gardens was normal, and normally distributed. It was 116.08 inches, and there were 182 rainless days.

When in the third quarter of the year labour began to desert, for a short time it was difficult to keep the lawns mown and the stream banks tidy. There was never in the year any spare labour for the completion of the Upper North Road.

5 conspicuous trees were lost.

The stream gave a little trouble, and cost about \$250 in repairs to its banks. Two of the plant houses were repaired. Mr. G. PENNY was so good as to give a supply of charcoal for the tables in the plant houses: and the Municipality allowed the use of a road roller for the cost of working it. Part of the middle road was re-metalled and part of the road near the entrance.

Seed of *Gloxinia* and *Streptocarpus* was ripened; and a plentiful supply of seedlings has been obtained. The Field Assistant's expeditions yielded 506 plants, notably *Dendrobium cruentum*, *D. secundum*, *D. Pierardi*, *D. Farmeri*, *D. tortile*, *Aglaonema oblongifolium* var. *Curtisii*, *Platynerium biforme*, var. *erectum*, Trang pepper, and an aquatic *Crinum*, believed to be the lost *C. stenophyllum*.

3,111 plants were sent out, and 1,528 packets of seed.

Of the plants sent out 2,800 were sold, 174 exchanged, and 137 given to the Municipality.

Labour in the Gardens was thus utilised:—for pot plants at the rate of 10.44 men per diem, on lawns 6.27, on trees 5.81, sweeping 3.71, bedding 2.44, on roads 3.03, in nurseries 2.63, on rockeries 0.90, and unclassified 0.49.

Other Charges.

Coconut Inspection.—The three Inspectors' work shows:—(1) in Singapore, 254 dying or dead coconut trees, 1,862 trunks, and 32 refuse heaps removed, with 210 notices served: (2) Malacca, Central and Jasin, 3,241 dying or dead coconut trees, 6,522 trunks and 416 refuse heaps removed with 443 notices served, 167 summonses taken out, and \$389 imposed in fines: and (3) Malacca, Alor Gajah, 269 dying and dead coconut or kabong trees, 696 trunks, and 2 heaps of refuse destroyed with 226 notices served, 16 summonses taken out, and \$36 imposed in fines. These figures indicate a considerable amount of work, but the efficiency can only be judged by the appearance of the country side, which in Malacca is improved. In Singapore it is not so, for where persuasion used to work, compulsion is becoming necessary. The Malacca owner has always neglected his coconut groves from idleness, and the rising cost of labour with the diminishing profit from the nuts makes no difference; but it is otherwise in Singapore where the owners are so largely Chinese.

There is a new Coconut pest in Malacca, a beetle, which is under study. It gives to the trees the same scorched appearance as does the moth *Brachartona*. *Brachartona* re-appeared in Singapore island at the end of the year.

The Mount Zion Coconut Plantation was looked after at a cost of \$171. Planting was continued.

The Goodwood Estate Rubber Plantation supplied rubber returning \$142 and a further quantity valued at \$90 was in hand at the end of the year. The cost of upkeep was \$341. As the Public Works Department was occupied in drainage operations for the first part of the year, weeding was then cut down. The drainage operations did harm to the trees whose deeper roots died from the raising of the water table. The land should not be in rubber.

Government House Domain—Disease broke out in the avenue of Angsana trees (*Pterocarpus indicus*) near the gate to Orchard Road. The avenue was immediately cut in the hope of restricting it. This disease, well known by its depredations, first in Malacca and then in Penang, is of fungal origin: it appeared in Pulau Brani in 1914, and from there it seems to have jumped to the Connaught Drive: next from the Connaught Drive it appeared half a mile away at Dhobi Ghaut and then one quarter of a mile further on in the Government House Grounds.

Besides the Angsana trees removed, four other trees have been lost. More than equivalent planting has been done.

The labour was used as follows:—for lawns and mowing grass at the rate of 11.79 men per diem, for trees 5.40, for sweeping and cleaning 4.95, for pot plants 4.14, at the Colonial Secretary's bungalow for all kinds of work 3.86, in nurseries 3.19, for bedding 2.77, in cultivating the plantation to the north 2.12, on paths 1.20, and unclassified 0.17.

Revenue and Expenditure of the Committees of Management.

	<i>Botanic Gardens, Singapore.</i>	<i>Waterfall Gardens, Penang.</i>	<i>Government House Domain, Singapore.</i>
REVENUE.	\$ c.	\$ c.	\$ c.
By balance in hand on 1st January, 1917	3,247 13	389 88	697 90
„ Government grants ...	12,376 00	4,960 00	5,876 00 1,200 00
„ Sale of plants and recoveries connected therewith ...	2,274 62	1,285 20	70 00
„ Sale of rubber ...	2,856 85	...	...
„ Advance payments ...	573 61	...	...
„ Miscellaneous recoveries, etc. ...	1,742 16	307 02	245 40
	<u>23,070 37</u>	<u>6,942 10</u>	<u>8,089 30</u>
EXPENDITURE.			
By salaries and wages ...	12,060 40	4,321 33	5,569 06
„ bills ...	9,848 03	1,208 26	1,549 48
„ undrawn balance with Treasury ...	...	15 15	...
„ balance on 31st December, 1917 ...	1,161 94	1,397 36	970 46
	<u>23,070 37</u>	<u>6,942 10</u>	<u>8,089 30</u>

I. HENRY BURKILL,
Director of Gardens, S. S.

BOTANIC GARDENS,
SINGAPORE, 25th February, 1918.

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS

FOR THE YEAR

1918

BY

I. HENRY BURKILL, M.A.,

Director of Gardens, Straits Settlements.



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1919.

Annual Report of the Director of Gardens for the Year 1918.

The Committees of Management were constituted as follows:—

Gardens Committee, Singapore: the Hon'ble Mr. F. J. PIGOTT, the Hon'ble Mr. H. W. FIRMSTONE, the Hon'ble Mr. H. MARRIOTT, the Hon'ble Mr. F. M. ELLIOT, the Hon'ble Dr. LIM BOON KENG, Mr. W. E. HOOPER, Mr. St. V. B. DOWN, with the Director of Gardens; *Committee for the Management of the Waterfall Gardens, Penang*: the Hon'ble the Resident Councillor (Mr. W. C. MICHELL), Mr. LAWRIE C. BROWN, Mr. L. H. BELL, with the Director of Gardens; *Committee for the Management of the Government House Domain*: the Aide-de-Camp to His Excellency the Governor (Mr. M. E. SHERWOOD) with the Director of Gardens.

In Singapore the Members of the Committee constituted themselves into monthly boards of visitors.

The more responsible staff consisted of the undersigned as Director, Messrs. E. H. MATHIEU and J. d'A. PEREIRA as temporary extra Assistant Curators and Mr. MOHAMED HANIFF, a Field Assistant, these three being in executive charge respectively, of the Economic Garden, Singapore, the Botanic Garden, Singapore, and the Waterfall Garden, Penang. The Assistant Director was absent on military duty throughout the year. The service of the clerk, Mr. J. S. ISAAC, terminated with the year, and his successor is one of the trained clerical service of the Colony.

Labour was in deficit, and wages had to be raised considerably. The influenza epidemic passed lightly over the Gardens: there were but two deaths, both in Hospital.

Finance.

The Colonial Government acted generously towards the Department adding a considerable sum to what they had become accustomed to give. At the same time they decided to hold in future a fuller responsibility, determining that after 1918 the Committees should no longer keep and use such revenue as the Gardens can make by sales, but draw their whole resources from the Colonial Treasury, unless there should fall to them "voluntary donations and subscriptions" such as Ordinance VII of 1878 contemplated. On this decision the several Committees paid in 1919 their balances of December 31st, 1918, into the Treasury. The Committees still possess the power of adjusting wages, and distributing their grants over the needs of the Gardens.

The revenue made in Singapore was \$10,001.39.

The following analysis of the sources whence it came is instructive. It shows a large recovery by the sale of ornamental plants.—

	1915.	1916.	1917.	1918.
	\$	\$	\$	\$
By sale of economic plants and seeds ...	1,588	1,150	887	1,097
Of ornamental plants & seeds ...	1,069	1,449	781	1,895
Of rubber ...	4,105	3,367	2,631	5,017
NETT REVENUE <i>carried forward</i> ...	6,762	5,966	4,299	8,009

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	1915.	1916.	1917.	1918.
	\$	\$	\$	\$
NETT REVENUE <i>brought forward</i> ...	6,762	5,966	4,299	8,009
By recoveries of expenses connected with sales ...	790	718	599	843
Not connected with sales ...	1,188	1,470	1,592	1,149
Total Receipts ...	8,740	8,154	6,490	10,001

The table shows larger receipts than usual for rubber, but of the total \$5,017.03, \$2,299 was for rubber manufactured in 1917, leaving \$2,718 as for rubber made in 1918.

The net revenue by the sale of ornamental plants in Penang was \$1,121.25.

Wages having been raised by nearly 40 per cent and more money being available, the labour bill in Singapore was 20 per cent above that of 1917 and with the rise in the cost of commodities the stores bill 30 per cent higher. In Penang the labour bill was 14 per cent above that of 1917 and the stores bill 40 per cent higher.

Buildings.

To the roof of the Exhibition House in Singapore a gable was added: and the west side was re-roofed with nibong laths to its great improvement. The laths are spaced to admit one-third of the direct sunlight.

Lines were constructed in Singapore for forty unmarried Tamil coolies and ten married Javanese. The construction of the Field Assistant's quarters was commenced.

Collections, Records and Investigations.

The receipts of plants and seeds were large, partly because the opportunities of acquiring local orchids were good, but chiefly because the usual supply of seeds from Britain was supplemented by a supply from the United States, and also in response to the increased activity of the Gardens resulting from the appointment of temporary officers in the place of the absentees. Many kind friends contributed plants and seeds, both residents in the Peninsula and abroad; and thanks are due to:—Messrs. J. F. BAILEY (Brisbane), H. BATTISCOMBE (Indo-Chine), L. C. BROWN, C. BODEN KLOSS (Indo-Chine), H. H. BARTLETT (Sumatra), St. V. B. DOWN, F. M. ELLIOT, F. W. FOXWORTHY, G. FARMER (Sierra Leone), G. GREIG, H. W. FIRMSTONE, V. KNIGHT, KWA TAU TZE, C. G. LA RUE (Sumatra), V. G. H. LUNBERG, H. B. MARSHALL (Rhio), E. D. MERRILL (China), C. G. MAY, W. S. MILLARD, (Bombay), the late R. W. MUNRO, G. P. OWEN, O. F. RICKETTS (Sarawak), G. REGARD (Mauritius), E. ROSTADOS, C. V. NEUBRONNER, B. K. SAHEB, J. SCEATS (Foochow), Dr. W. F. SAMUELS, C. P. WILLIAMS, G. P. WILDER (Hawaii), and C. L. WRAGGE (Auckland).

Dr. P. S. FALSHAW put at the disposal of the Gardens a very welcome supply of manure.

The entries of the "plants inwards" book in Singapore were 1,042 which, as has been shown in the Gardens Bulletin, II p. 137, is unusually large. These entries represent 1,390 living plants and 1,083 packets of seeds. Into the Penang Gardens were brought 640 living plants and 134 packets of seeds. A large part of the living plants brought into the Penang Garden were orchids obtained by Mr. HANIFF upon a successful collecting trip to Trang, Kassom, and Pungah, in Lower Siam.

It was recorded in the report for 1917, how rainy that year had been in Singapore, the month of January, 1918, was rainy too; thereafter followed a period when the temperature touched 66° F. several times; the rest of the year was evenly moist with frequent light rains. Probably the unusual conditions of 1918 had less to do with the unusual flowerings of 1918 than had the weather of 1917; but the extensive flowering of *Ravenala* in Singapore, the fruiting of *Passiflora edulis* in the Economic Garden, the beauty at times of *Bauhinia candida*, *Roupellia grata*, *Eranthemum malaccense*, and the *Browneas* were features of 1918 deserving notice.

In April insect pests were bad for a time; *Flacourtia Rukam* was defoliated by a caterpillar; *Ipomæa digitata* by *Euchromia* sp.; *Crinum asiaticum* by *Calogramma festiva*; and *Cassias* by *Catopsila crocale*. A *Zeuzera* damaged *Hibiscus* plants by

boring in the stems; and a beetle compelled the abandoning of rose cultivation upon certain areas in the Government Domain.

The rainfall in Penang was normal in amount and in distribution except for the phenomenal downpour of December 8th which did great damage in the Waterfall Gardens. The year in Penang was a splendid year for flowers; the forests were full of blossom in the first half, and afforded unique opportunities, which were taken, of collecting in flower trees, chiefly Dipterocarps. A date palm flowered in the grounds of a mosque in George Town and produced fruits which while infertile were of considerable size. The tree is twenty years old. That the date should fruit there is notable.

The rainfall records for the Gardens in both places are to be found in the Gardens' Bulletin. It is desirable for the better understanding of our cultures that other meteorological records should be kept, and plans are being laid for the keeping of them. The Library grows, and is very cramped in the old office. No binding was done in 1918.

The Herbarium work was continued just as in 1917. When the active fighting ended, the opportunity was taken of sending to Kew large numbers of specimens required there for the purpose of Mr. H. N. RIDLEY'S Flora of the Peninsula. In all 1,838 specimens were despatched being:—

- 726 to the Royal Botanic Gardens, Kew,
- 229 to the Forest Department at Kuala Lumpur,
- 191 to the Royal Botanic Gardens, Calcutta,
- 154 to the British Museum, South Kensington, London,
- 121 to the Bureau of Science, Manila,
- 108 to the University of Cambridge,
- 69 to the University of California,
- 39 to the Botanic Gardens, Brisbane,
- 30 to the Forest Research Institute, Dehra Dun.

The receipts amounted to about 2,300, being 1,650 from the Bureau of Science, Manila; 362 from the Botanic Garden Buitenzorg; nearly one hundred from Professor C. F. BAKER; and the considerable balance from the Forest Department, S. S. and F. M. S. The Department collected 1,200 numbers.

Owing to the want of mounting paper at the end of the year about 6,000 sheets awaited mounting.

Six different institutions were supplied with samples of timber of determined origin.

Mr. H. N. DIXON continued his help by naming mosses submitted to him, and Miss G. LISTER similarly Myxomycetes. Professor P. A. SACCARDO described 67 new fungi from Singapore, mostly from the Botanic Gardens or near thereto, collected by Professor C. F. BAKER. M. N. PATOUILLARD described others. Mr. E. D. MERRILL described several new Bornean flowering plants from the Gardens' Collections. The Director described two or three Malayan plants from living specimens in cultivation in Singapore or in Penang, and prepared an illustrated paper on the seedlings of such Dipterocarps as could be got. A paper upon new Malayan flowering plants was issued by Mr. H. N. RIDLEY.

Three parts of the Gardens' Bulletin were issued. They contain reports which may be grouped thus:—

- (1) on local economic value:—on various races of the radish, lettuce, tomato, bean, soy-bean, pea-nut, yautia, yam, rozelle and cola;
- (2) on cultivation:—"the control of damping off";
- (3) on insect pest:—*Catochryops pandava* on Cycads; *Plesiopea reichei* and *Promecotheca cumingii* on coco-nuts, a *Lema* on yams;
- (4) on fungal pests:—a Host-index to Penzig's, Saccardo's and Raciborski's papers on Javanese fungi;
- (5) on Botany:—orchid notes;
- (6) a history of the Gardens to 1888.

Botanic Gardens, Singapore.

Most of the new work in 1918 was done about the Lake. In the Dell at its head a third pool was made and the three linked together in such a way that a gentle flow of clean water from the Tyersal Lakes passes through them. When that improvement had been effected the two brick tanks which had served the two older pools were filled with earth and planted over.

At the foot of the Lake, where the old outflow to the Nelumbium pond had become choked by tree roots, a new outflow was constructed with a fall on it. The water falls from giant clam shells into a coral channel.

A large circular bed was made on Lawn E. and planted with the nucleus of the *Hibiscus* collection.

Two acres behind the Director's house were cleared, and prepared for planting, being the last ground available in the Botanic Gardens for carrying specimen trees.

Mention has already been made of the exceptional flowering in the early half of the year. The flower beds and gable part of the Exhibition house were well filled with flowers raised by two Chinese Gardeners: for their raising additional benches were put up in the nursery.

The remaining old *Arenga* palms near the Tyersal Gate being untidy were removed. In anticipation of this, interplanting was done several years ago.

The fungus *Rosellinia radiciperda* which was reported on in 1916 as destructive in the Gardens' jungle has destroyed a new area. Liming was resorted to.

Dipladenia Harrisii fruited for the second time, and *Arenga undulatifolia* for the first.

Eight large trees were lost by the storms, but none entailing a serious loss.

Labour, men, women and boys was used in the following way:—for pot-plants at the rate of \$10.14 per diem; for cleaning roads and paths \$7.00; for the lawns \$13.44; for bedding \$5.87; for nurseries \$1.50; for sweeping \$4.12; for caring for the trees \$2.60; for rockeries \$0.49; for cleaning the lakes \$0.65 and miscellaneous \$1.35.

Economic Garden.

A proposal had been put forward in the year 1917 by the Singapore Housing Commission that the Economic Garden should be built over. It was most disturbing and among other courses it compelled the transfer to sites in the Botanic Garden of plants which had to be preserved and were likely to outgrow the possibility before the plans for a new Economic Garden at a distance could put fresh land into the possession of the department. Unfortunately by doing this, we lost the only tree of the Bornean Bilian, together with two or three less valuable plants which did not stand the disturbance. One of the three Caryocars after heavy pruning, was moved successfully. The young selected rubber trees were all sent to Kuala Lumpur to save them. Fortunately the proposals for scrapping the Economic Garden have not matured.

Food crops.—Following up the experiments of 1916 on vegetables, attention was concentrated upon the Lima Bean; and a new supply of seed having been obtained from the United States where from the race "Siebert's early" proved desirable, plans were prepared and preparations made to raise and put eight hundred pounds of its seed into the hands of cultivators. This work is in the hands of Mr. MATHIEU, and has been the subject of a report in the Gardens Bulletin.

Out of the hundred races of the greater yam under trial about fifty were weeded out as unprofitable. Among the yautias one race of excellent flavour was detected. *Ocimum tuberosum*, which had been brought into the Garden in 1916 grew well, and the area under it was increased it might be called the "Singapore Potato".

Very encouraging results were got at first with a certain race of maize, but in the second crop a blight did much damage to it. With a red rozelle an excellent crop was raised returning 2,650 lbs. of the edible calyces per acre.

Indigo.—Upon the receipt of cuttings from Kelantan, it had been found that the indigo grown there is *Indigofera anil*, a species favoured by the Chinese. As we know that the planters in Java some time ago gave up this species for *I. guatemalense*,

and then gave up *I. guatemalense* for *I. arrecta*, it appeared probable that indigo cultivation in Kelantan might be improved by changing the species. With that in mind some plots of indigo were grown; but the experiments are incomplete. *I. Anil* in these experiments suffered from blight. *I. sumatrana* did better; but then *I. sumatrana* in Java was displaced by *I. anil*.

I. linifolia and *I. trifoliata* gave good crops as green manure.

Arboretum.—The Suari nut, *Caryocar nuciferum*, fruited again; but the seed could not be got to germinate.

Rubber.—Tapping was stopped in August when the price of rubber upon the Singapore market was at its lowest. From then to the end of the year the trees were rested. Up to that time labour was employed in the preparation of rubber at the rate of 8.72 men per diem. Over the whole year the rate of Labour for various purposes was:—for rubber 6.64; for digging and cultivating the experimental plots 10.78; for cutting grass, 10.71; for nurseries, 6.47; for nursery stocks in pots, 1.99; for seed collecting, 1.57; on trees, 1.00; for sweeping, 15.61; on roads, 3.70; miscellaneous work, 1.44; and on the transfer of plants from the Economic Garden to new positions outside, 2.42.

Thefts in the first part of the year were very annoying.

Waterfall Gardens, Penang.

A great improvement was made in the Waterfall Gardens by smoothing the landslip above the central bridge and building a wall along the stream side. The bank now rises at this place from a five feet high wall, twenty-two feet to a ledge and is continued upwards for a further fifteen feet. At the close of the year only a few days work remained undone of the earthwork.

On December, the 8th, there was a phenomenal rain in Penang, with floods exceeding any remembered; the stream through the Gardens came down in spate, destroying the fernery fretting its banks, bringing down half of the foot bridge, cutting the main road by the Central Bridge, and breaking away round the upper dam. For a time all the spare labour had to be employed clearing away debris; and a special vote had to be asked for, to enable repairs to be done.

The new loop of the Upper North Road was completed and a sun rockery made by it. All the other roads in the upper half of the Gardens were narrowed as an economy.

The nucleus of a collection of Crotons was placed on the south side of the entrance gate; and cannas were bedded more extensively in the swampy hollow under the Reservoir.

Several interesting orchids flowered, it would be gratifying to find an artist willing and able to make paintings of the novelties flowered in Penang. *Tritonia Pottsii* and *Achimenes* in wire baskets were among the most interesting of the plants which flowered.

Plants were sent out to the number of 4,144, and of seeds 780 packets.

Labour was used as follows:—For pot plants at the rate 10.72 men per diem; on lawns, 5.91; on trees, 6.70; in sweeping, 3.15; in bedding, 3.00; on roads, 5.94; in the nurseries, 2.70; in the rockeries, 1.00 and unclassified, 1.00.

Other Charges.

Coco-nut Inspection.—Copra in 1918, was so unattractive that coco-nut palms were generally subject to neglect; but not more so than in 1917. In Singapore, 257 notices were served; in Malacca (Central division) 217; in Jasin, 213; and in Alor Gajah, 368. Five summons followed in Singapore, 34 in Malacca, 8 in Jasin, and 38 in Alor Gajah. The material causing the action was:—

	Dead trees.	Trunks or stumps.	Accumulations of rubbish.
In Singapore	247	1,963	98
In Malacca	323	786	215
In Jasin	234	412	214
In Alor Gajah	472	1,416	85

The number of notices served in Singapore has increased over the years of the War in the following way, in 1914, 110, then successively 176, 175, 210 and 257; but the number of dead trees to which they relate has not increased similarly.

The Malacca coco-nut pest, mentioned in the 1917 report proved to be the Hispid beetle, *Promecotheca cumingii* hitherto unrecorded as a pest in the Malay Peninsula, but known as one in the Philippine Islands. The centre of its attack was Tanjong Kling, and the extremes Malacca town and Pangkalan Balak; inland it extended little. Natural causes destroyed it.

The moth *Brachartona catoxantha*, did damage in the north-east of Singapore Island.

Mount Zion Plantation.—The coco-nut plantation at Mount Zion was looked after at a cost of \$186. Since its first planting it has cost \$1,573 and it has brought in about half that sum. It is a pity that the land was put under a crop of such duration as coco-nuts, seeing that now it is proposed to use it for building.

When extending the plantation in 1913 several races of the coco-nut were planted against each other. The result shows "klapa hijau" fruiting a little before "klapa jantong," "klapa sepong" and "klapa bulat," while "klapa nipah" comes into fruit a little later. The trees are magnificent.

Goodwood Estate Plantation.—So long as rubber was being made at the Gardens tapping was done on the Goodwood plantation. After it had been stopped the decision was arrived at to use the land for building purposes.

Government House Domain.—A considerable amount of renovation of plant-stands, etc., was done in the potting yard; and a new wire fence with cement post placed along the boundary towards Oldham Hall. The Angsana avenue which had disease in it already in 1917, was destroyed by the extension of the fungus, and *Cedrela* trees were planted in place of those lost. A fine *Araucaria* was lost near the Colonial Secretary's bungalow, white ants having got into it.

Labour was thus used:—for lawns at the rate of 13.42; for trees, 2.23; for sweeping 4.27; for pot plants, 3.18; at the Colonial Secretary's bungalow for all manner of work, 3.69; in nurseries, 2.97; in bedding, 4.77; on the plantation to the north side of the grounds, 0.67; on paths, 1.41; and on the erection of the new fence, or unclassified, 1.56.

Revenue and Expenditure of the Committees of Management.

REVENUE.	Botanic Gardens S'pore.	Waterfall Gardens Penang.	Govt. House Domain.
	\$ c.	\$ c.	\$ c.
By balance in hand on 1st January, 1918	1,161 94	1,397 36	970 46
Government Grants	12,376 00	5,660 00	7,076 00
	10,000 00	...	1,200 00
Sale of plants and recoveries connected therewith	4,733 54	1,203 81	60 00
Sale of rubber	5,017 03	...	...
Advance payments	565 83	...	...
Miscellaneous recoveries	686 02	355 25	43 25
Total	34,540 36	8,616 42	9,349 71

7

Expenditure of the Committee of Management.

EXPENDITURE.	Botanic Gardens S'pore.	Waterfall Gardens Penang.	Govt. House Domain.
	\$ c.	\$ c.	\$ c.
By salaries and wages	18,809 63	4,929 44	7,344 99
„ Bills	12,851 32	2,931 60	1,821 82
Balance on 31st December, held for va- rious creditors	231 46	700 00	...
Balance on 31st December, 1918, paid in 1919 into the Treasury	1,647 95	55 38	182 90
Balance of Government votes undrawn in the Treasury	1,000 00	...	...
Total	34,540 36	8,616 42	9,349 71

I. HENRY BURKILL,
Director of Gardens, S. S.

BOTANIC GARDENS,
SINGAPORE, 11th September, 1919.

Annual Report of the Director of Gardens for the Year 1919.

The three Committees of Management for different Gardens within the Department, with the coming in of the year 1919, ceased to have their own banking accounts, and paid their balances into the Treasury. The oldest of these Committees is the Gardens' Committee, Singapore: at its creation in 1878, it was composed of the Colonial Secretary, the Colonial Engineer, and a member of the Agri-Horticultural Society which had founded the Gardens in 1859. The official predominance, then so evident, was reduced in 1884 by the increase of the Committee to five, and by appointing all its members by name, instead of by title, except the Director of Gardens. It has since been increased to eight, with a majority that is quite unofficial.

Under these circumstances it was natural that the Government when largely increasing the votes to the Gardens, making themselves in fact wholly responsible for funds, should desire to direct the application of these more closely; and this has been done by dividing the money provided under several separate votes where formerly one lump sum was given.

The two other Committees,—for the management of the Waterfall Gardens, Penang, and for the Government House Domain—were created respectively in 1916 and 1914, the former of three members, two being officials, the latter purely official. Since 1916 the former has been undergoing enlargement by the increase of the unofficial element, following the natural course of its precursor.

On these Committees in 1919, the following very kindly served:—*on the Gardens Committee, Singapore*: Mr. St. V. B. DOWN (to December, 17th); the Hon'ble Mr. H. W. FIRMSTONE, Mr. W. E. HOOPER (to July 16th); Mr. J. G. HUBBACK (from December 18th); the Hon'ble Mr. W. LOWTHER KEMP (from April 28th); Mr. W. P. KER (from September 15th); the Hon'ble Dr. LIM BOON KENG; the Hon'ble Mr. H. MARRIOTT (to September 3rd); the Hon'ble Mr. C. G. MAY (from April 28th); the Hon'ble Mr. F. J. PIGOTT (to January 28th) and Mr. E. C. H. WOLFF (from September 4th); and *on the Committee for the Management of the Waterfall Gardens, Penang*, the Hon'ble the Resident Councillor (Mr. W. C. MICHELL to July 24th, and Mr. G. A. HALL afterwards); Mr. L. M. BELL and Mr. LAURIE C. BROWN. The *Committee for the Management of the Government House Domain* was composed of the Aide-de-Camp to His Excellency the Governor (Mr. M. E. SHERWOOD) and the Director of Gardens.

It is of passing interest that with the changes in control of expenditure, the volume of correspondence from the Gardens to the Secretariat in 1919 rose from the annual average of 150 letters to 243, and the correspondence with the Treasury from the average of 130 to 323: but some of this increase was brought about by general conditions.

Staff.

On July 20th Major T. F. CHIPP and Mr. F. FLIPPANCE took up their respective duties of Assistant Director of Gardens and Assistant Curator, Singapore Gardens.

The services of Mr. J. D'A. PEREIRA, an extra-Assistant Curator, thereupon ceased. The services of Mr. E. H. MATHIEU, also an extra-Assistant Curator, were retained to enable the Director to go on overdue furlough. The Director left the Settlements on September 12th; and Major CHIPP acted for the rest of the year.

As to the Field Assistants, Mr. MOHAMED HANIFF remained in executive control of the Waterfall Gardens, Penang; and Mr. G. B. DESHMUKH, who had arrived only on December 28th, 1918, was kept in training in Singapore.

A native subordinate, in Singapore, was told off for mosquito-destruction within the Gardens, his duties being the care of all places where mosquitos might breed.

Labour.

There was no difficulty in procuring labour at any season; but it had to be fed in Singapore on credit at one time, because the local rice-sellers suddenly withdrew credit; moreover wages had to be raised twice in Singapore and once in Penang to hold the forces together.

Finance.

To enable wages to be raised, an extension of the votes for the pay of gardeners and coolies had to be taken. The increased cost of everything is illustrated in the following statement:—

	1914.	1915.	1916.	1917.	1918.	1919.
	—	—	—	—	—	—
Labour cost:—	\$	\$	\$	\$	\$	\$
Singapore ...	14,267	11,943	12,418	12,060	18,809	21,212
Penang ...	4,779	3,899	3,825	4,321	4,929	5,482
Stores, Tools, etc.:—						
Singapore ...	8,152	7,949	8,200	9,848	12,851	10,588
Penang ...	1,092	1,035	1,133	1,208	2,931	2,110

Revenue to the amount of \$6,086.80 was made in Singapore, and to the amount of \$1,413.68 in Penang.

Buildings.

The Field Assistant's quarters, Singapore, were completed in January.

The iron work of the Plant House annexe in Singapore was repainted. The plant houses were re-roofed with bertam in Penang.

Investigations and Collections.

Living Collections:—

The Department gratefully acknowledges the gift of plants and seeds from:— Mr. St. V. B. DOWN, the Hon'ble Mr. H. W. FIRMSTONE, Dr. F. W. FOXWORTHY, Dr. H. J. GIBBS, Mr. V. KNIGHT, Prof. LLOYD of McGill University, Toronto, Mr. O. F. RICKETTS, Prof. J. F. ROCK of the College of Science, Hawaii, Mrs. WATERHOUSE, and Mr. P. J. WESTER of Lamao, Luzon, the Royal Botanic Gardens, Kew and Calcutta, the Botanic Gardens, Buitenzorg and Saigon, the Bureau of Science, Manila, and the College of Agriculture, Los Banos, the Agri-Horticultural Society of India and the Departments of Agriculture, Bombay, Egypt and Jamaica.

The entries in the plants inwards books ran to:—

Singapore,	1,443	representing	4,100	living plants and	1,286	packets of seed
Penang,	109	"	474	"	93	"

The inflow has never been larger (*vide* "Gardens Bulletin" II. 1919, page 137).

In Singapore *Crinum stenophyllum* flowered. It is a water-plant found a century ago by collectors sent out from Calcutta, but lost sight of again until the Department got it from Lower Siam by the agency of Mr. MOHAMED HANIFF.

Impatiens Curtisii was found a serviceable pot plant, the seeds having been brought from the Taiping Hills by Mr. G. P. OWEN in 1918. It refused to seed in Singapore, but is propagated by cuttings easily. *Millingtonia hortensis* flowered in the Singapore Gardens for the first time, but it has been grown in the district before: the trees are 17 years old.

Into the Penang Garden was introduced a white flowered *Impatiens mirabilis*. *Monochoria elata*, a Kedah plant introduced into the Penang Gardens a few years

ago, is found to do remarkably well in the Dato Kramat Park, Penang,—better there than in the Waterfall Gardens, apparently because it desires more sun than is got at the foot of the hill.

Pests.—The worst pest experienced was the human thief: there were several annoying thefts during the year, chiefly in the Economic Garden, Singapore, where the whole supply of particular plants was destroyed; and such thefts are likely to recur so long as the Gardens' coolies live among the experiments.

The caterpillar of a small moth of the genus *Pachygamla* damaged the leaves of *Solanum melongena*, the Trong; that of the moth *Artaxa citrina* was found destructive to seedlings of *Balanocarpus*, and that of the Pyralid *Syllapta derogata*, Fab., attacked cotton tree leaves. Mr. HOLMAN HUNT kindly identified the first and Mr. V. KNIGHT the second.

Papaya plants were damaged by a mite, and monkeys proved very troublesome by breaking off the tender parts of the shoot.

Fourteen local galls were submitted to Dr. DOCTERS VAN LEEUWEN at Buitenzorg for his determination and three tubes of insects to the Imperial Bureau of Entomology.

Dry collections.—Herbarium specimens were received gratefully from Prof. C. F. BAKER (100, being Fungi), the Botanic Gardens, Buitenzorg (202), the Government Botanist, Brisbane (30), and the Bureau of Science, Manila (20). The following were sent out:—

to the Royal Botanic Gardens, Kew	...	...	367
to the Bureau of Science, Manila	...	...	122
to Mr. G. C. Lloyd (fungi for determination, etc.)	...	...	102
to Prof. Oakes Ames	...	...	92
to the Royal Botanic Gardens, Calcutta	...	...	81
to the Botanic Gardens, Buitenzorg	...	...	79
to the Conservator of Forests, Kuala Lumpur	...	...	50
and lesser numbers to the Forest Research Institute, Dehra Dun, the University of Cambridge, the University of California, Professor C. F. BAKER, Dr. E. J. BUTLER, the Forest Laboratory, Spokane, U. S. A., the British Museum of Natural History and the Government Botanist, Brisbane	...	...	87
Total			980

Hand specimens of timbers, to the number of 75, were sent to the same destinations.

Mounting paper being still at a very high price, the mounting of specimens has been in general deferred.

The specimens of the genus *Strychnos* were loaned to the Assistant Director, Royal Botanic Gardens, Kew, for study and returned determined.

Botanic Gardens, Singapore.

By far the most important work done in the Botanic Gardens was the smoothing and planting of two-thirds of area Z which is towards Gallop Road: in doing so the opportunity was taken of duplicating some of the trees of the Economic Garden. It was not much duplication that could be done; but the declaration of the Singapore Housing Commission that the Economic Garden ought to be built over, threatened such an unexpected and serious blow at the activities of the Department that anything was worth doing; and no harm is done by possessing a few extra trees of important species. Labour did not permit of the whole of area Z being got into a tidy condition; but it will be done. Other conspicuous changes were the grassing of half of the Canna beds of the old "Rose-garden" and the extension of the lower Nursery to the Cluny lake. The extension of the Nursery is a response to the big demand for ornamental plants, whereof there were sent out in the year no fewer than

10,164 plants, with
68 packets of seed.

Among the plants sent out were four Wardian cases full, two of which were safely seen to Kew by the great kindness of Dr. G. E. BROOKE, of the Colonial Medical Service, and two by Mr. W. FOX, formerly of the Gardens Department.

The Gardens become more and more used; and it is necessary to think of creating new hubs or foci in them, other than the Bandstand Hill where now the numerous visitors chiefly seek air and ease; for this is clear that with Tanglin the unrivalled residential part of Singapore the area of the Gardens will be none too large for their service as a Park.

By the kindness of Lieutenant-Colonel L. B. BOYD-MOSS, C.M.G., D.S.O., and the Officers, the Band of the First Battalion, South Staffordshire Regiment, played in the Gardens, from soon after the time of the regiment's coming, twice monthly, and their Bugles played the retreat in alternate weeks.

Labour (men, women and boys) was used in the following way—for pot plants at the rate of 10.31 per diem; for cleaning roads and paths 11.17; for lawns 10.94; for bedding 8.19; for nurseries 3.59; for sweeping 3.71; for caring for the trees 1.44; for rockeries 0.26; for cleaning lakes 0.71; and miscellaneous 1.39.

Economic Garden, Singapore.

During the year all along the Riding road, in blocks 7, 13 and 14, an excellent demonstration of food crops was made: for the purpose all the labour that could be spared from other areas was got together and utilised at the rate of three men to an acre, to till that land. The effort was repaid by the number of visitors attracted to it. There were plots of hill-rice, millet and ragi of about 1/20 of an acre; plots of tuberous plants as artichokes, yams, sweet-potato, coleus, aroids, and diverse tapiocas; vegetables as amarantus, basella, gourds; different beans, such as tall and dwarf Lima-beans, yard-long beans, sword beans, all in series along the roadside, that the right way of cultivating them, and the proper yield to get might be obvious. After the end of the year the growing of agricultural crops was dropped, as they were for demonstration only; the growing of garden crops is being continued.

In the "Gardens Bulletin" several of these plots have been described, e.g. ragi, in Vol. 11 p. 206; hill paddy, p. 199; lima-bean, pp. 121 & 238; sword bean, p. 300; roselle, p. 242; etc. By the kindness of the "Singapore Free Press," the department was able to call attention to its crops through that newspaper.

As to the Lima-bean, having by experiment found that of a number of races one called "Sieberts early" made the best growth and the best return, the Department set to work to put 800 pounds of selected seed into the hands of cultivators about the Peninsula.

The Department had started, with the year, selective work on the papaya. Unfortunately a great mishap came—the carefully crossed fruits were stolen as they ripened.

The Department is endeavouring to propagate the selected rubber trees, 27 and 610 asexually, with the idea of getting a supply of stock to bear seed early. That raised from seed already has been made over to the Department of Agriculture.

About the middle of the year the Food Controller put funds at the disposal of the Gardens, whereby the area allotted to fruit was brought under food crops. It was then planted with fruit trees through the food crops. The whole result of the year's working was thus a considerable gain on the past.

The right to tap the rubber trees was let out through the year, the lessee being required to keep down the grass under the trees so that the Department had no need of sending labour into that part of the Garden. Scrub among the Sago palms was cut over from time to time and the ditches kept open. A little revenue was got from the Sago.

The number of economic plants sent out was 3,233, together with 629 packets of seed. While falling far short in number of the ornamental plants sent out, the despatch of economic plants shows a big increase: in 1914 it was 761 and in the following years it has been 1,094, 937, 2,539, 2,367, until in 1919, 3,233.

Labour:—upon the average 54 men, women or boys were employed in the Economic Garden daily. The average numbers put to different kinds of work were 34.42 to digging, weeding, and planting; 7.89 to keeping the grassy slopes in order; 1.68 on plants in pots; .03 on seed-collecting; 1.25 on tree-cutting or pruning; 0.73 on sweeping; 2.72 on roads; 1.57 on ditching; 4.37 in transferring to area Z of the Botanic Garden plants from the Economic Garden, and 1.55 on

miscellaneous work, including watching. The number employed on the grassy slopes and on roads was less than in 1918 but rather more than in 1917; but the number employed on cultivation considerably more; this was possible firstly because the Food Controller's funds enabled 10 men to be employed over the last four months of the year, and these men tilled the area of 5 acres on the hilltop, and secondly because the men freed by the cessation of rubber tapping were turned on to cultivation.

The successive increases of men employed on clean-weeded areas in the Economic Garden have been, 9.81 per diem in 1917, 17.35 in 1918 and 34.42 in 1919; the number per acre being 2 over some parts of the ground, and 3 over other parts.

Waterfall Gardens, Penang.

In the report for 1918, damage done by a storm on December 8th had to be recorded: the first work of 1919 was the obliteration of its marks. The bed of the stream under the Upper bridge was concreted in places; the foot bridge below it was restored; the north wing of the Central bridge rebuilt and lengthened; a low dam was constructed just above it to direct the current; and the wing of the old Mill dam was rebuilt. At the same time the high bank above the Central bridge on the south side of the stream received a final smoothing and was grassed over, thus removing the last disfigurement of a landslide which occurred in 1908. The year 1919 did not suffice for the restoration of the old ferneries, nor was the entrainment of the stream just under the Central bridge altogether finished.

The collections were maintained, and by a trip into Siam, Mr. MOHAMED HANIFF added a number of desirable plants.

The growth in Penang of *Cupressus glabra* has been most pleasing: this little cypress from arid regions in the United States, on steep sandy slopes by the Gardens' gate, is doing remarkably well. It does badly in Singapore.

One of the three large trees of *Araucaria excelsa* fell, destroyed by white ants.

The number of plants sent out was 2,304, with 203 packets of seed.

The Municipal Band played in the Gardens after dark on four occasions.

Labour was utilised thus:—for pot plants at the rate of 9.92 men per diem; on lawns 6.12; on trees 8.52; sweeping 2.95; bedding 3.05; on roads 3.94; in nurseries 1.92; on rockeries 2.00; and unclassified 0.65.

Government House Domain.

There was made no change of moment in the Government House domain; nor were any conspicuous trees lost.

Labour was used thus:—on the lawns 16.09 men per diem; on bedding 6.46; for pot plants 4.10; and in nurseries 3.00; for hedging and tree-cutting 1.80; for sweeping and cleaning 3.11; for shrubberies 2.03; at the Colonial Secretary's Bungalow for all manner of work 4.49, and unclassified .37.

Miscellaneous.

The Coconut Inspector in Singapore, taking the title of Sub-Inspector of Agriculture, was transferred to the Agricultural Department, but, under an arrangement with the Director of Agriculture, continued to report weekly at the Gardens.

After the middle of the year the control of the Mt. Zion coconut land ceased.

As many tours has made the Director of Gardens very familiar with the Malacca river valley, a report on the neglected rice-land in it was asked for and submitted to the Government.

BOTANIC GARDENS,
SINGAPORE, 11th December, 1920.

I. HENRY BURKILL,
Director of Gardens, S. S.

Annual Report of the Director of Gardens for the Year 1920.

During 1920 the following were so good as to give their services upon the Committees of Management:—

Gardens' Committee, Singapore.—Messrs. D. BEATTY (from June 8th), and P. CUNLIFFE (from February 8th), the Hon'ble Mr. H. W. FIRMSTONE (to February 27th), Messrs. W. G. HENNINGS (from November 9th), E. S. HOSE (to October 1st), J. G. HUBBACK and W. P. KER (to May 18th), the Hon'ble Dr. LIM BOON KENG, the Hon'ble Mr. W. LOWTHER KEMP, the Hon'ble Mr. F. J. PIGOTT, and Mr. E. C. H. WOLFF (to May 20th). *Committee of Management for the Waterfall Gardens, Penang:* the Hon'ble the Resident Councillor (Mr. G. A. HALL, to February 27th, and Mr. H. W. FIRMSTONE afterwards), Mr. LAWRIE C. BROWN, Mr. J. D. FETTES, Captain H. M. S. HAUGHTON (from May 14th), Dr. P. LISTON (from June 17th), and Mr. HASTINGS RHODES (from July 16th). *The Committee of Management for the Government House Domain* consisted of the Director of Gardens with the Aide-de-Camp to His Excellency the Governor.

Staff.

The Director was on leave until June 13th. Up to that date Major T. F. CHIPP, Assistant Director, acted as Director. On December 14th Major CHIPP proceeded on leave, prior to transfer to West Africa. Except for a short period of deputation to lay out the Gardens at Bel Retiro, Penang Hill, Mr. FLIPPANCE was at his post of Assistant Curator, Botanic Gardens, Singapore, throughout the year; and Mr. MOHAMED HANIFF, except for a short period of illness, was in executive charge of the Waterfall Gardens, Penang. Mr. E. H. MATHIEU remained in the service of the Department until July 31st, having executive charge of the Economic Garden. Mr. G. B. DESHMUKH worked under him until then, and afterwards took over his charge. Mr. KASTAWI BIN JALIL, Foreman Gardener in the Botanic Gardens, died on July 7th—a great loss to the Department in which he had served 33 years.

Labour.

Labour, uneasy at rising prices, was difficult to retain, and after the first quarter of the year, the forces were never at proper strength. In March, in Singapore, all the younger Javanese—mostly mowers—were induced to leave for a rubber estate; but the older Javanese in service, who are married and suitably housed in a compact colony of their own, stuck by the Department: the Tamils changed considerably. In Penang almost all the trained men were lost over the early months of the year; and great difficulties were experienced in maintaining the amenities of the Gardens after that misfortune. There is wisdom in domiciling a force of married men. Twice in Singapore, and twice in Penang, wages were increased; but the Department had lost men and it was impossible in the general scarcity of labour to rebuild the forces satisfactorily. By the sanctioned increments the coolie's wage stands at 70 cents per diem in Singapore, and at 62 cents in Penang. The increases amount to 75 and 93 per cent on the wage of 1916, or to 20 and 60 per cent on that of 1919. Since 1916 reliable watchmen have been hard to get at a wage increased by 56 per cent.

It was found necessary to supply rice on credit to daily labour in Singapore: and the same course would have been useful in Penang, but difficulties stood in the way of adopting it.

Expenditure and Revenue.

With the labour force so much under due strength there was in Singapore a saving upon the votes for labour which covered, with a considerable margin, the rise in daily wages; but an extension had to be taken to meet the greater rise in Penang, and also the rise on the Government House Domain. Small extensions had to be taken also for travelling expenses, and for other expenditure in Singapore and in Penang. Revenue in Singapore came in well, attaining \$9,316.81, made up of \$6,101.29 from rubber, and \$3,215.52 from the sale of plants. It fell, however, in Penang where it was \$975.72. The demands of the public showed no sign of decrease during the year; but the loss of labour in Penang diminished the supplying power there.

To replenish the stock of tools, etc., which had of necessity been kept at the lowest possible margin during the war, a larger expenditure than usual was necessary. Expenditure on timber and manure was also great. The local prices of timber might be regarded as exorbitant, and the price of manure as excessive; but there was so much competition for the available supplies of these that the sellers could sell as they pleased. Compensating economies were effected in material of other kinds.

It is becoming a permanent condition that cattle manure is difficult to get in anything like adequate quantities; and therefore artificial manures have been ordered. The price of cattle manure at the same time is high; so that the amount required by the Gardens now costs five times as much as it did ten years ago. Opium refuse, which was thrown into the sea formerly, is being used in the Gardens experimentally as a manure. It decomposes very slowly;—this in part because it has been thought necessary to bury it deeply; but it is possible that by mixing it with cow dung, and so innoculating it with bacteria, sufficiently rapid decomposition will be set up.

Buildings.

In Singapore a new building holding the Director's office, library and laboratory was erected, but not completed. The servants' quarters at the Director's and Assistant Director's houses were improved. Lines for ten married Javanese were built. The water-pipe system to the Javanese lines and subordinate quarters was relaid by the Municipality from the Cluny Road main instead of from the remoter Dalvey Road main, thus liberating piping enough for the water supply to the new laboratory. In Penang the lines were repainted.

Investigations and Collections.

Living collections.—The Department gratefully acknowledges the receipt of plants and seeds from Mrs. M. BARRY, Mrs. A. W. D. DOVE, Mrs. KNOLLEMA, Messrs. C. BODEN-KLOSS, H. M. BONE, G. FARMER (*Elaeis*), H. L. JEPPESEN, C. V. PIPER, E. L. VILLIERS (*Cannas*), C. L. WRAGGE, Dr. F. W. FOXWORTHY, Dr. J. D. GIMLETTE, Professor J. F. ROCK, Dr. J. J. SMITH, the Royal Botanic Gardens, Kew and Calcutta, the Botanic Gardens, Bangalore, Brisbane, Buitenzorg, Georgetown-Demerara, Hongkong and Port Darwin, the Colonial Gardens of Laecken, the State Nursery, Gwalior, the Agricultural Departments of the Federated Malay States, Burma, Sierra Leone and Mauritius, the Bureau of Agriculture, Philippine Islands, the Department of Agriculture, United States, the Director of Museums, Federated Malay States, the Agri-Horticultural Society of India, and the Conservators of Forests, Perak and Nigeria.

The Director visited Calcutta and Kew when on leave; and the results of requests made there have come in: from the Royal Botanic Gardens, Calcutta, the Department received 57 plants, together with a consignment

of twenty plants of the celebrated Nagpur Orange; from the Agri-Horticultural Society of India, which has its head quarters in Calcutta, were received 130 races of *Canna*, some races of *Hedychium* and various other plants; from Kew 55 plants were received, both ornamental and economic.

The numbers of entries in the Department's "Plants inwards" books were:—

in Singapore 1,254, referring to 621 plants and 1,067 packets of seed;
in Penang 108, referring to 523 plants and 92 packets of seed.

Seed of twenty-seven palms new to the collection has been obtained. *Attalea Cohune*, the palm used by the rubber collectors on the Amazon for smoking "hard para," began to fruit in the Gardens, where it has been for about twenty-five years. A few years ago a local newspaper advocated the growing of this palm for the oil in its seed, without first ascertaining in any way the age at which it fruits. Experience does not justify advocating it.

Believing greatly in the value of the Avocado pear for Malaya, the Department has got plants of five races now, and hopes to get more.

The Director of Agriculture, Sierra Leone, upon request, sent tubers of the yam found by him to be a heavy yielder in West Africa and called in his reports the "Hausa potato". It proved to be the Lesser Yam of the East Indies (*Dioscorea esculenta*).

The Director of Agriculture, Philippine Islands, upon request, supplied suckers of the five best races of pisang (banana) grown in his experiment stations.

As the Department of Agriculture, Ceylon, had advertised the stock of young plants held for the purpose of supplying the public, for the sake of comparison a count of corresponding stock in the Colony was taken at the end of the year; and the numbers were found roughly equal, there being 37,400 plants in Singapore, and 11,100 in Penang.

Dry collections.—Herbarium specimens were gratefully received from the Forest Department (1,052), the Bureau of Science, Manila (882), the Botanic Gardens, Buitenzorg (444), His Highness the Prince BONAPARTE (134), Professor C. F. BAKER (100, being his sixth century of Malayan Fungi), Mr. A. R. SANDERSON (26), Dr. LIM BOON KENG, Messrs. C. BODEN-KLOSS, J. C. MOULTON, G. E. PERRY, and F. W. SOUTH.

The Assistant Director, Major CHIPP, collected fungi through Singapore island and to a small extent elsewhere; the Director after his return collected the higher plants in a few places, e.g., Penang, Ipoh, Kuala Lumpur, Gemas. Mr. MOHAMED HANIFF collected, upon a visit for seeds, in the neighbourhood of Sungei Siput, Perak, and Major MOULTON collected for the Department upon the Upper Baram river in Sarawak about Lio-matu and on the mountains to the north of it. Dr. DOCTERS VAN LEEUWEN, Director of the Botanic Gardens, Buitenzorg, visited the Settlements, and collected galls which particularly interest him; and this splendid opportunity was taken by the Department of submitting to him a further collection of galls.

Major CHIPP's "List of the Fungi of the Malay Peninsula" (Gardens' Bulletin, II. pp. 311-418) is a very important publication from the Herbarium.

The following herbarium specimens were sent out:—

to the Royal Botanic Gardens, Kew	...	696
to the Botanic Gardens, Buitenzorg	...	279
to Mr. G. C. LLOYD (fungi)	...	261
to the Bureau of Science, Manila	...	255
to the Royal Botanic Gardens, Calcutta	...	125
to the Botanic Gardens, Brisbane	...	107
and lesser numbers to Miss G. LISTER, Messrs. N. PATOUILLARD, E. CHEEL, W. HALES, J. R. WEIR, H. N. DIXON, J. GROVES, M. PERSIN, and the Department of Agriculture, Pretoria	...	220
Total	..	1,943

All the herbarium specimens of the order Urticaceae were loaned to the Superintendent of the Royal Botanic Gardens, Calcutta, for working up in the Materials for a Flora of the Malay Peninsula. The specimens of the genus *Canavalia* were loaned to Kew.

Mounting paper being still at a very high price, mounting was in general deferred, but cannot be deferred longer as the accumulation of unmounted material is becoming unworkable.

For the gift of books the Department is indebted to His Highness the Prince BONAPARTE (his Notes Ptéridologiques, fasc. VIII), Professor OAKES AMES (his Studies in the family Orchidaceae, Vol. VI), Dr. A. O. FARWELL (several tracts on pharmacology, etc.), the Trustees of the British Museum (Mr. FAWCETT's and Dr. RENDLE's Flora of Jamaica, Vol. IV), the Forest Department (valuable manuscript on Malayan economic plants), the Editor of the Gardens' Bulletin (his numerous exchanges), and generous departments such as the Agricultural Department of the United States, the Botanic Gardens, Buitenzorg, etc.

Botanic Gardens, Singapore.

Every resident knows how motor traffic has increased in Singapore; and the wear and tear upon the Gardens' roads has greatly increased with it. In the report of 1912 it was remarked that a few cars then entered the Gardens at night; but now, band-nights excluded, from a count the average number is found to be 24 with a maximum of 107. On a band-night there may be nearly five hundred cars parked on and near the Band-stand, until there is no room for more. No count of the numbers of cars which travel over the Gardens' roads by day has been possible.

The Liane road was re-metalled; but not the other roads which were down for repair. There was difficulty in procuring laterite.

The Wormias were cut back at the head of the lake. Further planting was done in the Area Z.

Of changes altering the appearance of the Gardens there were none in 1920, except that one of the beautiful trees of *Casuarina sumatrana*, near the main gate, died; and an *Agathis* by the old office and four other trees were blown down on July 8th. The old tree of *Canarium commune*, which is older than the Gardens and stands near the Plant House, began to exhibit signs of disease. The patch of the Gardens' Jungle attacked by *Rosellinia echinata* showed signs of recovery in the centre; but the fungus is still on the periphery. A ditch was dug and heavily limed to check its spread southwards; and liming resorted to on the margins generally. The recovery is marked by a big and very vigorous growth of the fern *Nephrolepis acuta*. An unusual dry spell at the close of November produced a wealth of colour, making many plants flower in profusion.

By the kindness of Lieutenant-Colonel L. B. BOYD-MOSS, C.M.G., D.S.O., and of the officers, the band of the 1st Battalion, South Staffordshire Regiment, played in the Gardens twice monthly, and the Regimental Drums beat "retreat" in the afternoon of one day in each alternate week.

The demand for plants was greater than it has ever been; and the number sent out was 14,253, together with 262 packets of seed. Two wardian cases were sent to Kew under the charge of the Assistant Director, containing, with ornamental plants, certain Malayan fruit trees asked for by His Excellency the Governor of Sierra Leone.

Labour was used in the following ways:—for pot-plants, at the rate of 8.90 men per diem; for cleaning roads and paths, 11.46; for lawns, 9.15; for bedding 5.17; for nurseries 3.53; for sweeping 4.51; for caring for the trees 2.56; for rockeries, 0.09; for cleaning the lakes, 0.69; and miscellaneous 1.83.

Much of the aggressive grass, *Paspalum platycaule*, was removed from the lawns; but it comes back if the smallest scrap is left, just as the allied *P. dilatatum* does in the Botanic Gardens, Sydney, whence it is reported as the worst local pest.

Economic Garden.

Through the first part of the year, the food-crop demonstration by the Riding track, which was described in the last report, demanded a considerable amount of Mr. MATHIEU's attention; but gradually its agricultural crops were abandoned for horticultural crops. As the cropping changed the area was marked out into plots each of 1/10 of an acre; and the same was done upon the hill-top: this gives a far more business-like arrangement than existed before. The plots on the hill-top were kept in food crops inter-planted with fruit trees, because the cultivation for the food-crops was of benefit to the young fruit trees.

The right to tap the rubber trees was let for the first half-year for \$800 per mensem; but the tappers who were paid by the lessee on results grew very apt to over-tap. The same was the case with the tappers of the lessee who followed for one month only; and after that the amount offered for the rights was not worth accepting against the trouble of seeing that the tappers did not damage the trees. In 1919 a fibre-yielding race "altissima" of the Rozelle had been brought into the Gardens where it grew well. Fibre in 1920 was made from it by Mr. MATHIEU in the way that jute is prepared; and was pronounced at the Imperial Institute, London, equal to the first marks of jute. It is desirable now to know if a yield so much greater than that of jute can be got as will enable it to be produced by labour far more expensive than the labour which produces jute. The isolated 23-year-old Brazil nut tree continues to flower yearly but has not produced fruit yet, as the pair of 30-year old trees have been doing for a number of years. Is it a consequence of isolation? The 20-year old *Caryocar* trees have produced imperfect fruits for a second time. It is hoped that they will soon produce fertile seeds. *Swarzsia pinnata* flowered and fruited.

Of economic plants 665 were sent out and 162 packets of seed. These included nearly 6,000 seeds of the African Oil Palm.

Labour.—Over the first five months of the year upon an average 65 men, women or boys were employed daily in the Economic Garden. The record of the distribution of labour for those months is missing. Over the remaining seven months, when the average number of men could not be raised above 35, labour was put to different kinds of work as follows:—digging, weeding and planting 12.87 per diem; for keeping the grass slopes tidy 8.19; on plants in pots, 2.03; on tree-cutting and pruning 0.86; on sweeping 3.50; on roads 2.61; on ditching 1.02; in burying opium-refuse, 1.99; on miscellaneous work, 1.40.

The deep burying of the opium-refuse is costing too much, and other methods of using it are being tested.

Waterfall Gardens, Penang.

As in Singapore, so in Penang there has been a great increase in the amount of motor traffic in the Gardens. This entails an increase of labour upon the roads; and taking the year as a whole two additional men have been required in the Waterfall Gardens for that service. It has been decided to attempt an economy by asphaltting the lower roads. To make traffic safer, the gate has been widened to almost 40 feet.

A weir was built upon the stream just above the Central Bridge to control the current; and another weir is planned to hold up still water under the bridge.

The metal work of the plant houses was repainted by the Gardens' labour, and re-roofing done. At the same time tiles were laid upon the southern bench of house No. 9.

To increase the colour in the Gardens, beds were made round the trees lining the Lower South Road and in the hollow of the upper part of the Gardens; but wild pigs damaged the latter. To keep the shrubberies tidier, three rubbish pits were made upon the outskirts of the Gardens and all other dumps of leaves destroyed. The vegetation in the Swimming Bath gully

was thinned; and an old footpath reopened from it to the site of the abandoned Gardens' bungalow whence there is a good view. It is a practice to plant palms that have become too large to retain in the plant-houses and other woody plants as available near this footpath. The Swimming Bath gully is an ideal Aroid garden.

The palms *Latania Commersonii* and *Attalea Cohune*, flowered but did not fruit; the *Latania*s were given to the Gardens in 1911 by Mr. LOGAN and were a few years old then. *Dichopsis Gutta*, the gutta taban, fruited at the age of 21 years. Among orchids a *Spathoglottis*, got by Mr. HANIFF on Kedah Peak, proved on flowering to be *S. affinis* which is new to the Peninsula. A curious and probably new *Habenaria* from Champawn also flowered. Hydrangeas which had long remained flowerless in Singapore after having been sent to Penang flowered, but not conspicuously.

During the year 2,270 plants were sent out, and 426 packets of seed.

Labour was utilised as follows:—for pot-plants at the rate of 9.24 men per diem; on lawns 6.69; on trees 2.25; on sweeping 1.92; on bedding 2.75; on roads 8.37; on nurseries 2.05; on rockeries 0.33; on lakes and on drainage work 0.64; on the repair of the plant houses including repainting 0.94; on work upon the stream bank 0.50; and miscellaneous 0.31.

Government House Domain.

Labour upon the Government House Domain was thus distributed:—on the lawns at the rate of 13.33 men per diem; on bedding 7.99; in nurseries 3.99; on pot-plants 3.29; in house-decoration 0.85; for hedging and tree-cutting 2.81; for sweeping and cleaning 4.08; for shrubberies 1.92; at the Colonial Secretary's house for all manner of work 4.25; and at the Private Secretary's house 1.86.

Miscellaneous.

The Sub-Inspector of Agriculture, under an arrangement with the Director of Agriculture, continues to report weekly at the Gardens.

The acting Director visited Penang and Kuala Lipis to advise in connection with the laying out of the grounds of the Crag Hotel and of the then-proposed Residency at Kuala Lipis.

I. HENRY BURKILL,

Director of Gardens, S. S.

BOTANIC GARDENS,

SINGAPORE, 6th May, 1921. [No. 4606/21.]

Duplicate

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With the labour force so much under due strength there was in Singapore a saving upon the votes for labour which covered, with a considerable margin, the rise in daily wages; but an extension had to be taken to meet the greater rise in Penang, and also the rise on the Government House Domain. Small extensions had to be taken also for travelling expenses, and for other expenditure in Singapore and in Penang. Revenue in Singapore came in well, attaining \$9,316.81, made up of \$6,101.29 from rubber, and \$3,215.52 from the sale of plants. It fell, however, in Penang where it was \$975.72. The demands of the public showed no sign of decrease during the year; but the loss of labour in Penang diminished the supplying power there.

To replenish the stock of tools, etc., which had of necessity been kept at the lowest possible margin during the war, a larger expenditure than usual was necessary. Expenditure on timber and manure was also great. The local prices of timber might be regarded as exorbitant, and the price of manure as excessive; but there was so much competition for the available supplies of these that the sellers could sell as they pleased. Compensating economies were effected in material of other kinds.

It is becoming a permanent condition that cattle manure is difficult to get in anything like adequate quantities; and therefore artificial manures have been ordered. The price of cattle manure at the same time is high; so that the amount required by the Gardens now costs five times as much as it did ten years ago. Opium refuse, which was thrown into the sea formerly, is being used in the Gardens experimentally as a manure. It decomposes very slowly;—this in part because it has been thought necessary to bury it deeply; but it is possible that by mixing it with cow dung, and so innoculating it with bacteria, sufficiently rapid decomposition will be set up.

Buildings.

In Singapore a new building holding the Director's office, library and laboratory was erected, but not completed. The servants' quarters at the Director's and Assistant Director's houses were improved. Lines for ten married Javanese were built. The water-pipe system to the Javanese lines and subordinate quarters was relaid by the Municipality from the Cluny Road main instead of from the remoter Dalvey Road main, thus liberating piping enough for the water supply to the new laboratory. In Penang the lines were repainted.

Investigations and Collections.

Living collections.—The Department gratefully acknowledges the receipt of plants and seeds from Mrs. M. BARRY, Mrs. A. W. D. DOVE, Mrs. KNOLLEMA, Messrs. C. BODEN-KLOSS, H. M. BONE, G. FARMER (*Elaeis*), H. L. JEPPESEN, C. V. PIPER, E. L. VILLIERS (*Cannas*), C. L. WRAGGE, Dr. F. W. FOXWORTHY, Dr. J. D. GIMLETTE, Professor J. F. ROCK, Dr. J. J. SMITH, the Royal Botanic Gardens, Kew and Calcutta, the Botanic Gardens, Bangalore, Brisbane, Buitenzorg, Georgetown-Demerara, Hongkong and Port Darwin, the Colonial Gardens of Laecken, the State Nursery, Gwalior, the Agricultural Departments of the Federated Malay States, Burma, Sierra Leone and Mauritius, the Bureau of Agriculture, Philippine Islands, the Department of Agriculture, United States, the Director of Museums, Federated Malay States, the Agri-Horticultural Society of India, and the Conservators of Forests, Perak and Nigeria.

The Director visited Calcutta and Kew when on leave; and the results of requests made there have come in: from the Royal Botanic Gardens, Calcutta, the Department received 57 plants, together with a consignment

of twenty plants of the celebrated Nagpur Orange; from the Agri-Horticultural Society of India, which has its head quarters in Calcutta, were received 130 races of *Canna*, some races of *Hedychium* and various other plants; from Kew 55 plants were received, both ornamental and economic.

The numbers of entries in the Department's "Plants inwards" books were:—

in Singapore 1,254, referring to 621 plants and 1,067 packets of seed;
in Penang 108, referring to 523 plants and 92 packets of seed.

Seed of twenty-seven palms new to the collection has been obtained. *Attalea Cohune*, the palm used by the rubber collectors on the Amazon for smoking "hard para," began to fruit in the Gardens, where it has been for about twenty-five years. A few years ago a local newspaper advocated the growing of this palm for the oil in its seed, without first ascertaining in any way the age at which it fruits. Experience does not justify advocating it.

Believing greatly in the value of the Avocado pear for Malaya, the Department has got plants of five races now, and hopes to get more.

The Director of Agriculture, Sierra Leone, upon request, sent tubers of the yam found by him to be a heavy yielder in West Africa and called in his reports the "Hausa potato". It proved to be the Lesser Yam of the East Indies (*Dioscorea esculenta*).

The Director of Agriculture, Philippine Islands, upon request, supplied suckers of the five best races of pisang (banana) grown in his experiment stations.

As the Department of Agriculture, Ceylon, had advertised the stock of young plants held for the purpose of supplying the public, for the sake of comparison a count of corresponding stock in the Colony was taken at the end of the year; and the numbers were found roughly equal, there being 37,400 plants in Singapore, and 11,100 in Penang.

Dry collections.—Herbarium specimens were gratefully received from the Forest Department (1,052), the Bureau of Science, Manila (882), the Botanic Gardens, Buitenzorg (444), His Highness the Prince BONAPARTE (134), Professor C. F. BAKER (100, being his sixth century of Malayan Fungi), Mr. A. R. SANDERSON (26), Dr. LIM BOON KENG, Messrs. C. BODEN-KLOSS, J. C. MOULTON, G. E. PERRY, and F. W. SOUTH.

The Assistant Director, Major CHIPP, collected fungi through Singapore island and to a small extent elsewhere; the Director after his return collected the higher plants in a few places, e.g., Penang, Ipoh, Kuala Lumpur, Gemas. Mr. MOHAMED HANIFF collected, upon a visit for seeds, in the neighbourhood of Sungei Siput, Perak; and Major MOULTON collected for the Department upon the Upper Baram river in Sarawak about Lio-matu and on the mountains to the north of it. Dr. DOCTERS VAN LEEUWEN, Director of the Botanic Gardens, Buitenzorg, visited the Settlements, and collected galls which particularly interest him; and this splendid opportunity was taken by the Department of submitting to him a further collection of galls.

Major CHIPP's "List of the Fungi of the Malay Peninsula" (Gardens' Bulletin, II. pp. 311-418) is a very important publication from the Herbarium.

The following herbarium specimens were sent out:—

to the Royal Botanic Gardens, Kew	...	696
to the Botanic Gardens, Buitenzorg	...	279
to Mr. G. C. LLOYD (fungi)	...	261
to the Bureau of Science, Manila	...	255
to the Royal Botanic Gardens, Calcutta	...	125
to the Botanic Gardens, Brisbane	...	107
and lesser numbers to Miss G. LISTER, Messrs. N. PATOUILLARD, E. CHEEL, W. HALES, J. R. WEIR, H. N. DIXON, J. GROVES, M. PERSIN, and the Department of Agriculture, Pretoria	...	220
Total	...	1,943

All the herbarium specimens of the order Urticaceae were loaned to the Superintendent of the Royal Botanic Gardens, Calcutta, for working up in the Materials for a Flora of the Malay Peninsula. The specimens of the genus *Canavalia* were loaned to Kew.

Mounting paper being still at a very high price, mounting was in general deferred, but cannot be deferred longer as the accumulation of unmounted material is becoming unworkable.

For the gift of books the Department is indebted to His Highness the Prince BONAPARTE (his Notes Ptéridologiques, fasc. VIII), Professor OAKES AMES (his Studies in the family Orchidaceae, Vol. VI), Dr. A. O. FARWELL (several tracts on pharmacology, etc.), the Trustees of the British Museum (Mr. FAWCETT's and Dr. RENDLE's Flora of Jamaica, Vol. IV), the Forest Department (valuable manuscript on Malayan economic plants), the Editor of the Gardens' Bulletin (his numerous exchanges), and generous departments such as the Agricultural Department of the United States, the Botanic Gardens, Buitenzorg, etc.

Botanic Gardens, Singapore.

Every resident knows how motor traffic has increased in Singapore; and the wear and tear upon the Gardens' roads has greatly increased with it. In the report of 1912 it was remarked that a few cars then entered the Gardens at night; but now, band-nights excluded, from a count the average number is found to be 24 with a maximum of 107. On a band-night there may be nearly five hundred cars parked on and near the Band-stand, until there is no room for more. No count of the numbers of cars which travel over the Gardens' roads by day has been possible.

The Liane road was re-metalled; but not the other roads which were down for repair. There was difficulty in procuring laterite.

The Wormias were cut back at the head of the lake. Further planting was done in the Area Z.

Of changes altering the appearance of the Gardens there were none in 1920, except that one of the beautiful trees of *Casuarina sumatrana*, near the main gate, died; and an *Agathis* by the old office and four other trees were blown down on July 8th. The old tree of *Canarium commune*, which is older than the Gardens and stands near the Plant House, began to exhibit signs of disease. The patch of the Gardens' Jungle attacked by *Rosellinia echinata* showed signs of recovery in the centre; but the fungus is still on the periphery. A ditch was dug and heavily limed to check its spread southwards; and liming resorted to on the margins generally. The recovery is marked by a big and very vigorous growth of the fern *Nephrolepis acuta*. An unusual dry spell at the close of November produced a wealth of colour, making many plants flower in profusion.

By the kindness of Lieutenant-Colonel L. B. BOYD-MOSS, C.M.G., D.S.O., and of the officers, the band of the 1st Battalion, South Staffordshire Regiment, played in the Gardens twice monthly, and the Regimental Drums beat "retreat" in the afternoon of one day in each alternate week.

The demand for plants was greater than it has ever been; and the number sent out was 14,253, together with 262 packets of seed. Two wardian cases were sent to Kew under the charge of the Assistant Director, containing, with ornamental plants, certain Malayan fruit trees asked for by His Excellency the Governor of Sierra Leone.

Labour was used in the following ways:—for pot-plants, at the rate of 8.90 men per diem; for cleaning roads and paths, 11.46; for lawns, 9.15; for bedding 5.17; for nurseries 3.53; for sweeping 4.51; for caring for the trees 2.56; for rockeries, 0.09; for cleaning the lakes, 0.69; and miscellaneous 1.83.

Much of the aggressive grass, *Paspalum platycaule*, was removed from the lawns; but it comes back if the smallest scrap is left, just as the allied *P. dilatatum* does in the Botanic Gardens, Sydney, whence it is reported as the worst local pest.

Economic Garden.

Through the first part of the year, the food-crop demonstration by the Riding track, which was described in the last report, demanded a considerable amount of Mr. MATHIEU's attention; but gradually its agricultural crops were abandoned for horticultural crops. As the cropping changed the area was marked out into plots each of $1/10$ of an acre; and the same was done upon the hill-top: this gives a far more business-like arrangement than existed before. The plots on the hill-top were kept in food crops inter-planted with fruit trees, because the cultivation for the food-crops was of benefit to the young fruit trees.

The right to tap the rubber trees was let for the first half-year for \$800 per mensem; but the tappers who were paid by the lessee on results grew very apt to over-tap. The same was the case with the tappers of the lessee who followed for one month only; and after that the amount offered for the rights was not worth accepting against the trouble of seeing that the tappers did not damage the trees. In 1919 a fibre-yielding race "altissima" of the Rozelle had been brought into the Gardens where it grew well. Fibre in 1920 was made from it by Mr. MATHIEU in the way that jute is prepared; and was pronounced at the Imperial Institute, London, equal to the first marks of jute. It is desirable now to know if a yield so much greater than that of jute can be got as will enable it to be produced by labour far more expensive than the labour which produces jute. The isolated 23-year old Brazil nut tree continues to flower yearly but has not produced fruit yet, as the pair of 30-year old trees have been doing for a number of years. Is it a consequence of isolation? The 20-year old *Caryocar* trees have produced imperfect fruits for a second time. It is hoped that they will soon produce fertile seeds. *Swartzia pinnata* flowered and fruited.

Of economic plants 665 were sent out and 162 packets of seed. These included nearly 6,000 seeds of the African Oil Palm.

Labour.—Over the first five months of the year upon an average 65 men, women or boys were employed daily in the Economic Garden. The record of the distribution of labour for those months is missing. Over the remaining seven months, when the average number of men could not be raised above 35, labour was put to different kinds of work as follows:—digging, weeding and planting 12.87 per diem; for keeping the grass slopes tidy 8.19; on plants in pots, 2.03; on tree-cutting and pruning 0.86; on sweeping 3.50; on roads 2.61; on ditching 1.02; in burying opium-refuse, 1.99; on miscellaneous work, 1.40.

The deep burying of the opium-refuse is costing too much, and other methods of using it are being tested.

Waterfall Gardens, Penang.

As in Singapore, so in Penang there has been a great increase in the amount of motor traffic in the Gardens. This entails an increase of labour upon the roads; and taking the year as a whole two additional men have been required in the Waterfall Gardens for that service. It has been decided to attempt an economy by asphaltting the lower roads. To make traffic safer, the gate has been widened to almost 40 feet.

A weir was built upon the stream just above the Central Bridge to control the current; and another weir is planned to hold up still water under the bridge.

The metal work of the plant houses was repainted by the Gardens' labour, and re-roofing done. At the same time tiles were laid upon the southern bench of house No. 9.

To increase the colour in the Gardens, beds were made round the trees lining the Lower South Road and in the hollow of the upper part of the Gardens; but wild pigs damaged the latter. To keep the shrubberies tidier, three rubbish pits were made upon the outskirts of the Gardens and all other dumps of leaves destroyed. The vegetation in the Swimming Bath gully

was thinned; and an old footpath reopened from it to the site of the abandoned Gardens' bungalow whence there is a good view. It is a practice to plant palms that have become too large to retain in the plant-houses and other woody plants as available near this footpath. The Swimming Bath gully is an ideal Aroid garden.

The palms *Latania Commersonii* and *Attalea Cohune*, flowered but did not fruit; the *Latantias* were given to the Gardens in 1911 by Mr. LOGAN and were a few years old then. *Dichopsis Gutta*, the gutta taban, fruited at the age of 21 years. Among orchids a *Spathoglottis*, got by Mr. HANIFF on Kedah Peak, proved on flowering to be *S. affinis* which is new to the Peninsula. A curious and probably new *Habenaria* from Champawn also flowered. Hydrangeas which had long remained flowerless in Singapore after having been sent to Penang flowered, but not conspicuously.

During the year 2,270 plants were sent out, and 426 packets of seed.

Labour was utilised as follows:—for pot-plants at the rate of 9.24 men per diem; on lawns 6.69; on trees 2.25; on sweeping 1.92; on bedding 2.75; on roads 8.37; on nurseries 2.05; on rockeries 0.33; on lakes and on drainage work 0.64; on the repair of the plant houses including repainting 0.94; on work upon the stream bank 0.50; and miscellaneous 0.31.

Government House Domain.

Labour upon the Government House Domain was thus distributed:—on the lawns at the rate of 13.33 men per diem; on bedding 7.99; in nurseries 3.99; on pot-plants 3.29; in house-decoration 0.85; for hedging and tree-cutting 2.81; for sweeping and cleaning 4.08; for shrubberies 1.92; at the Colonial Secretary's house for all manner of work 4.25; and at the Private Secretary's house 1.86.

Miscellaneous.

The Sub-Inspector of Agriculture, under an arrangement with the Director of Agriculture, continues to report weekly at the Gardens.

The acting Director visited Penang and Kuala Lipis to advise in connection with the laying out of the grounds of the Crag Hotel and of the then-proposed Residency at Kuala Lipis.

I. HENRY BURKILL,
Director of Gardens, S. S.

BOTANIC GARDENS,
SINGAPORE, 6th May, 1921. [No. 4606/21.]

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS,

STRAITS SETTLEMENTS,

FOR THE YEAR

1921

BY

I. HENRY BURKILL, M. A.,

Director of Gardens, Straits Settlements.



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1922.

Annual Report of the Director of Gardens for the Year 1921.

The following gave their valuable services upon the Committees for the Management of the Gardens:—

Gardens Committee, Singapore: Mr. D. BEATTY (to January 22nd), Mr. P. CUNLIFFE (to May 11th), the Hon'ble Mr. V. GIBBONS (from February 9th), Mr. W. G. HENNINGS (to September 12th), Mr. J. G. HUBBACK (to April 10th), the Hon'ble Dr. LIM BOON KENG (to September 2nd), the Hon'ble Mr. J. H. W. PARK (from June 28th), Sir JOHN C. PETER (from June 28th), the Hon'ble Mr. F. J. PIGOTT (to March 25th), Mr. J. W. SIME (from June 28th), Mr. W. A. SIMS (from June 28th), and Mr. E. C. H. WOLFF.

Committee for the Management of the Waterfall Gardens, Penang: the Hon'ble the Resident Councillor (Mr. G. A. HALL), Mr. LAWRIE C. BROWN, Mr. J. D. FETTES, Captain H. M. S. HAUGHTON (to September 19th), Mr. F. T. KINDER (from September 19th), Dr. P. LISTON, Mr. HASTINGS RHODES, and Mr. C. R. SAMUEL (from September 29th).

The Director of Gardens is *ex-officio* upon both committees.

Labour.

Labour was plentiful. The coolies' wages were reduced in Singapore from 70 cents per diem to 55; and the wages of gardeners were reduced also. The reductions were recognised by the men as inevitable, and did not cause any serious break in the labour force.

As the budget estimates for the year had been prepared upon a high wage, the reduction made it possible to employ additional men who were used for the work of deepening the Lake and for filling the two ponds below it. In the Government House Domain the surplus funds lapsed.

In Penang wages were reduced by two cuts to 55 cents. The money there freed, enabled the work of restoring the Fern-Rockery to be prosecuted.

Revenue and Expenditure.

The revenue in Singapore was \$2,572.93 by ornamental plants, and \$464.63 by economic plants: out-of-pocket expenses caused by the sales and recovered, amounted to \$825.26, making \$3,862.82. The amount paid into the Treasury in Penang was \$1,067.17, being \$929.20 by the sale of plants and \$137.97 by recoveries.

Buildings.

The Department in the first quarter of the year entered into possession of the new building containing the Director's office, library and laboratory.

Investigations and Collections.

Living collections.—The Department's thanks to the following donors are here recorded:—Drs. P. S. CRAMER, F. W. FOXWORTHY, H. J. GIBBS, and LIM BOON KENG; Professors HARRISON SMITH and J. F. ROCK; the Hon'ble Mr. J. MITCHELL; Mrs. ANTHONY, Mrs. BURKILL, Mrs. FLIPPANCE;

Messrs. ABDUL KADIR, AHMED BIN HASSAN, LAWRIE C. BROWN, P. L. CHAFANJON, A. DE VILLELE, ST. V. B. DOWN, DAVID FAIRCHILD, G. FARMER, W. P. HANDOVER, A. MONTEFIORE, G. P. OWEN, B. K. SAHEB, and C. L. WRAGGE; the Royal Botanic Gardens, Kew, the Botanic Gardens, Brisbane, Buitenzorg, Port Darwin, the Seychelles and Trinidad; the Departments of Agriculture, Bombay, British North Borneo, Egypt and the United States of America; the Chief Conservator of Forests, Nyasaland; the Deputy Conservator of Forests, Lakhimpur, Assam; the Forest Ranger, Larut; and the firm of MM ANDRIEUX-VILMORIN et Cie.

Living plants were brought into the collections from Selangor by the Director and by Mr. BEST; from Penang Hill by Mr. FLIPPANCE; from Lankawi and Terutau by Mr. MAHOMED HANIFF and from Sibolangit, Sumatra, by the plant-collector MAHOMED NUR, working under Dr. FOXWORTHY and Mr. LOERZING.

The entries in the "Plants-inwards" books were 1,141 in Singapore, relating to 1,471 plants and 1,191 packets of seed, 160 in Penang, relating to 1,801 plants and 149 packets of seed.

The Gardens played a part in the introduction into cultivation of the anti-leprosy plants, *Gynocardia odorata*, *Taraktogenos Kurzii* and *Hydnocarpus* spp., raising plants from the seed which the Department of Agriculture, U. S. A., collected by the agency of Professor ROCK. Professor ROCK proceeded through Siam, Burma and Assam in the quest of the seed; and that the result of his labours might not be lost through the death of the seed in transit, he selected a few Gardens as recipients, one being Singapore's. The seedlings were easily raised, thanks to Professor ROCK's care in collecting seed, and are now well established. The writer some years ago with the assistance of Dr. D. HOOPER was also able to show that seeds of *Gynocardia odorata* only come into the market dead, and the oil rancid, because the seed is so carelessly collected.

The Jardin Colonial of Laeken supplied seed of Congo coffees, and of Congo Elæis. The Department of Agriculture, Ceylon, supplied some excellent races of the sweet potato. The Department of Agriculture, U. S. A., gave seed of Avocado pears of repute. By exchange excellent samples of some Burmese orchids were got from the Botanic Garden, Maymyo. The Conservator of Forests, Nyasaland, was so good as to supply seed of the Mlanji Cedar, *Widdringtonia Whytei*.

This interesting and desirable Conifer has not succeeded in Singapore; but there is a seedling alive in the Waterfall Gardens, Penang, which Garden as regards Conifers shows a more suitable climate than Singapore; so that *Cupressus glauca* grows well in it, whereas it has been lost from the Singapore Gardens; and *Pinus Merkusii* planted in it has reached twenty feet in height, whereas it has stopped growing in Singapore at five feet.

Casuarina sumatrana gave a welcome supply of seed in Singapore, and has been reproduced.

A gratifying success in Singapore has been with *Caryocar nuciferum*, of which the first seedling now exists. *Caryocar villosum* is growing well in Singapore.

Pests.—Pests were very troublesome in Singapore towards the end of the year, when there was an outbreak of the palm beetle *Protocerus colossus*, accompanied by some abundance of *Rhynchophorus ferrugineus* and *Oryctes rhinoceros*. It is thought that the unusual dry weather in July favoured them. The following palms were attacked by the *Protocerus*,—*Archontophoenix Alexandræ*, *Attalea Cohune*, *Chrysalidocarpus lutescens*, *Cyrtostachys Lakka*, *Elæis guineensis*, *Licuala horrida* and *L. Rumphii*, *Livistona Hoogendorpii* and *L. Kingiana*, *Phoenix humilis* var. *Ræbelinii* and *Sabal princeps*. At the same time *Rhynchophorus ferrugineus* was found in *Phoenix dactylifera*, *P. zeylanica* and *Livistona chinensis*; and larvæ of one or of the other, but too immature for certainty, were extracted from the stems of *Orania regalis* and *Stevensonia grandis*.

The attack was got under in a couple of months by handpicking.

It is *Oryctes rhinoceros* which makes the tunnels into palms that *Rhynchophorus ferrugineus* uses for egg-laying; and it seems probable that the same happens with *Protocerus colossus*. Several years ago Mr. RIDLEY recorded that the Rhinoceros beetle can mature in rich humus; in the course of suppressing the attacks described, an instance of this was found. Mr. RIDLEY upon another occasion remarked that palms in the Gardens died slowly some short time after an unusual spell of dry weather; is it not possible that the dying then was due also to an outbreak of *Protocerus colossus*?

Orchid beetles were troublesome. A caterpillar probably of the genus *Zeuzera* was extracted from the branches of a wild *Litsa* and from the branches of the Avocado pear. *Papilio polytes* did some damage to *Citrus* trees in February.

The Gardens' only plant of *Warczewiczia* suffers considerably from the attack of an insect which damages the foliage; it was observed that while the lake was half empty the attack abated.

Dry collections.—Herbarium specimens were gratefully received from the Bureau of Science, Manila (1138), from Mrs. and Miss BURKILL (140 Sumatran plants), the Botanic Gardens, Buitenzorg (324), the Botanic Gardens, Brisbane (100), the British Museum of Natural History (82 plants of New Guinea), Professor OAKES AMES, Cambridge, Mass., (72), the National Herbarium, Pretoria (14 fungi) and Dr. WEIR, Washington, U. S. A. (18 fungi). Photographs of plants were generously given by Mr. E. GATTEY, Mr. W. MAKEPEACE, Professor J. F. ROCK and Mr. E. H. WILSON, and drawings by Miss A. M. BURKILL.

Herbarium specimens were sent out as follows:—

to the Royal Botanic Gardens, Kew	...	...	641
to the Bureau of Science, Manila	...	...	551
to the Botanic Garden, Buitenzorg	...	...	450
to the Forest Research Officer, Kuala Lumpur	...	...	100
to the British Museum of Natural History	...	...	98
to Harvard University, Cambridge, Mass.	...	...	75
to the University of California	...	...	64
to the University of Cambridge	...	...	60
to the Arnold Arboretum	...	...	50
to the Botanic Gardens, Brisbane	...	...	45
and for the favour of determination to Prince ROLAND BONAPARTE, 33 ferns, to Mr. H. N. DIXON, 30 mosses, to Mr. G. C. LLOYD, 8 fungi, to Professor C. F. BAKER, 3 coccids, and to Miss G. LISTER, 1 myxomycete	...	...	75
			<hr/> 2,209 <hr/>

Botanic Gardens, Singapore.

A vote of \$700 had been taken for a slight cleaning away of silt at the the upper end of the lake when the Anti-mosquito Committee, as a preliminary to work which they wished done on the ponds in the adjoining Tyersal grounds, approached the Gardens Committee on the subject of the lakes and ponds in the Gardens. The result was an undertaking on the part of the Gardens Committee to fill the Nelumbium and Limnanthemum ponds at the foot of the lake with the silt to be got from the Gardens' Lake, and a recommendation that the Cluny Lake should be filled also. With a reduction in coolies' wages in sight, the Gardens Committee saw the possibility of accomplishing the filling of the ponds by means of savings on the Gardens' labour bill, and that at the same time a much more effective deepening of the lake could be brought about than the small vote of \$700 promised. Meanwhile the Municipality was able to come to an agreement with the State of Johore, as landlord of Tyersal, for the draining of the Tyersal ponds; and as it was desirable to await operations there before beginning in the Gardens, and also to get wages down, a commencement was postponed until June 1st: but from that date to the end of the year the Gardens lake was kept only half filled, while

a special gang of coolies dug the accumulated mud of fifty years from the shallower parts of the lake-bed. The *Nelumbium* pond was soon filled; but the lake did not supply filling enough for more than two-thirds of the *Limnanthemum* pond.

Upon the inflow from the Tyersal ponds to the Gardens lake two pools existed in the Dell. The level of their waters was above the bed of the Tyersal ponds, and they were kept filled only because the sluice from the Tyersal ponds had been allowed to get out of order, the water escaping instead through the masonry above it. It was conceded that the Gardens had no right to the accidental head of water which made the feeding of the pools possible; and consequently alterations in the Dell became necessary upon the draining of the Tyersal ponds. To maintain the Dell, therefore, the two pools were lowered and dug into one, and connected with the inflow and with the lake by 2 feet culverts admitting fish freely; the sides were concreted; and the coral banks, now higher and steeper, were rebuilt. This made the dell-pools to such an extent a part of the lake as to be in no way a source of mosquitoes. The spoil from this work also went into the *Limnanthemum* pond.

At the foot of the Lake Niven's 5 feet high escape channel towards Holland Road was blocked up, and the small escape channel towards Napier Road was doubled and provided with an overflow pipe, dropping below the escape channels so as to carry away all the water. In doing this work the surface of an old roadway was discovered 18 inches under ground, leading towards the junction of Napier and Holland Roads. That roadway, which must have been closed in 1866, is not on any existing map of the Gardens.

The sides of the islet were steepened; the *Wormias* on it were cut out, and *Randia macrantha* and *Bougainvillea* planted in their place. The latter however will not grow there.

It is of passing interest to remark that the following weeds came up on the exposed mud, and reached flowering in 65 days,—*Jussiaea fissendrocarpa*, *Vandellia crustacea*, *Euphorbia aspera* and *Panicum indicum*; and that these sedges and grasses reached flowering in 80 days,—*Eleusine indica*, *Paspalum conjugatum*, *Paspalum platycaule*, *Ischaemum Ridleyi*, *Cyperus Haspan*, *C. Irya*, *C. umbellatus*, *Kyllingia monocephala*, and *Fimbristylis aestivalis*. *Panicum indicum* showed the phenomenon of vivipary. There stands on the bank of the lake a tree of *Albizzia moluccana*, and the half of its seeds fall into the water: many of them germinated on the exposed bank at the south end of the lake, to which they had been floated; and it was most interesting to find that in the soil which had been for years submerged they produced the nitrogenous tubercles of the Leguminosæ. On the bank above them *Desmodium triflorum* of the same order existed, and became more vigorous as the subsoil below it became drier.

Borassus Machadonis flowered in June near the Plant-house.

Four large trees were lost by storms, and the big *Pterocarpus indica* on Lawn E died of Angsana disease. The disease still remains obscure.

The number of ornamental plants sent out from the Gardens was 16,481 and the packets of seed 773.

By the kindness of the officers, the band and the drums of the South Staffordshire Regiment played four times a month in the Gardens, the cost being met by the Municipal Commission.

Economic Garden, Singapore.

No tapping was done: there was an application for a lease of the rubber trees which was refused. All attempts to graft the selected rubber trees failed, partly in consequence of flooding, and partly from unknown causes. The attempt to graft will be renewed at a place away from the area liable to flooding.

Theobroma pentagona fruited. It is poor-yielding cacao. The Brazil-nut trees which are oldest bore abundantly.

The plantains imported from Manila began to fruit, proving our best races also theirs.

Experiments with garden vegetables were continued, particularly with lettuces. Carrots grew unexpectedly well.

The Government's decision to build the Raffles Memorial College in the Economic Garden overlies everything connected with it. The attempt is being made to propagate in any possible way the good plants that are in it; and an application has been made for permission to transfer them to a new site.

Of economic plants 1,532 were sent out in 1921 and of seed 202 packets.

Waterfall Gardens, Penang.

Mention has been made above of the cut in wages which enabled extra labour to be employed; it permitted the employment of about eight men beyond the average of previous years, with the help of a small sum transferred from a Singapore vote. The work of four of these men went into the restoration of the Fern-Rockery, and of three into better mowing. The amount of sweeping was increased towards the end of the year.

The Fern-Rockery is now again well on the way to becoming the beauty spot that it was.

At the top of the Swimming-bath gully a rustic bridge has been built and rockeries made at the ends of it with flowering plants on them. Additional flower-beds have been dug around the Bandstand hill. The nursery was partially overhauled; and shrubs were planted on the big bank over the entrance gate.

The lower roads were coated with Tarco. Many of the old Pandans were removed from the upper part of the Gardens. The Eucalypts perish one by one, and another was lost. The hill-top where the bungalow once stood, was partially cleared and vistas cut towards the Waterfall and towards the island of Pulau Jerejak.

Xylopia Curtisii flowered in the Gardens, and so did *Hydrangea Hortensia*.

The Municipal Commissioners in November consented to let, at a nominal rental, to the Gardens the block of land at the Gardens' gate whereon was the Vegetable Farm. As soon as possible it will be brought into a tidy condition, the better to preserve the amenities of the place. The part near the road will be planted with ornamental shrubs; and the part at the back used as a nursery.

The cataloguing of the plants in the Gardens is in progress, Mr. HANIFF being responsible for numbering the trees and for collecting material for the purpose of determination or authentication.

There were sent out 2,626 plants and 163 packets of seed, which is a slight increase on 1920, but less than in the years before.

Government House Domain.

After trying in vain all sorts of expedients to stop trespass over the grass in the Domain, a watchman was engaged in October. It will be necessary to retain him permanently.

A motor mower was put into use; but it cannot yet be regarded as a success. The rubber plantation within the Domain towards the Municipal Filter-beds was removed, and many trees of *Poinciana regia* planted among the remaining tembusu trees. The golf course was diverted towards that side, and the area brought into a better condition. New beds were dug on the upper lawns, and filled with Cannas. Several trees were removed having grown too big for their places, and some were lost by storms, notably in the south-west corner by Kramat Road, where it is necessary to raise up a fresh screen against certain very ugly buildings.

I. HENRY BURKILL,

Director of Gardens, S. S.

6th July, 1922. [No. 5495/22.]

STRAITS SETTLEMENTS.

ANNUAL REPORT

OF THE

DIRECTOR OF GARDENS,

STRAITS SETTLEMENTS,

FOR THE YEAR

1922

BY

I. HENRY BURKILL, M. A.

Director of Gardens, Straits Settlements.



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1923.

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Annual Report of the Director of Gardens for the Year 1922.

The Committees for the Management of the Gardens were constituted as follows, and an acknowledgment is due to all who kindly gave their services : —

<i>Gardens' Committee, Singapore :</i>		<i>Committee for the Management of the Waterfall Gardens, Penang :</i>	
The Hon'ble Mr. V. GIBBONS to May 8th.		The Hon'ble the Resident Councillor Mr. G. A. HALL to September 9th.	
Mr. W. E. HOOPER, from June 23rd.		Mr. R. SCOTT from September 10th to November 16th.	
The Hon'ble Mr. W. LOWTHER KEMP from June 23rd.		Mr. A. B. VOULES from November 17th.	
The Hon'ble Mr. J. W. H. PARK.		Mr. LAWRIE C. BROWN.	
Sir JOHN PETER.		Mr. J. D. FETTES to March 20th.	
Mr. J. M. SIME to April 17th.		Mr. F. T. KINDER to August 17th.	
Mr. W. A. SIMS.		Dr. P. LISTON.	
The Hon'ble Mr. E. C. H. WOLFF.		Mr. HASTINGS RHODES.	
The Director of Gardens.		Mr. A. ROGERS from August 18th.	
		Mr. C. R. SAMUEL.	
		The Director of Gardens	

On July 13th Mr. R. E. HOLTUM joined the Gardens' staff as Assistant Director. Throughout the year Mr. F. FLIPPANCE held executive charge of the Waterfall Gardens, Mr. G. A. BEST of the Botanic Gardens, Singapore, Mr. E. L. SHAW of Parks, Singapore, and Mr. J. LENNON of the Economic Garden, Singapore. One of the two posts of Field Assistant was vacant.

Labour.

Labour was obtained at the reduced wages of the second half of 1921, with somewhat less coming and going than in that year : but still the Singapore roster shows 210 new engagements in the twelve months, which means that the labourer on the average stays but eight months.

Revenue and Expenditure.

The revenue made in Singapore by the sale of plants and seeds was \$2,634.37 : of it \$1,577.29 came from the sale of ornamental plants, \$506.88 from the sale of economic plants and \$541.49 from recoveries of transport expenses and from miscellaneous sales. Nothing was made out of rubber.

The revenue made in Penang by the sale of plants and seeds was \$1,062.93, being almost entirely from the sale of ornamental plants.

The Municipalities of Singapore and of Georgetown, Penang, contribute towards the upkeep of the Department \$300 and \$1,200 respectively in return for advice upon roadside trees, etc.; and the Municipality of Singapore, further, meets the expenditure incurred by reason of music in the Gardens.

Expenditure in Singapore was greatly reduced: the cost of labour was \$18,315 against \$33,294 in 1921: and of stores, tools, travelling, books and book-binding \$14,013 against \$17,235.

Half of this reduction had been anticipated in preparing the estimates: the other half was by savings effected during the year.

The expenditure on labour in Penang was \$900 less than in 1921 and upon stores, tools and miscellaneous \$560 less.

Investigations and Collections.

For many years the local rainfall has been read in the Botanic Gardens, Singapore. From September, 1922, the observations were extended to temperature, evaporation and humidity, the instruments having been supplied by Dr. GILBERT BROOKE, and the readings are daily transmitted to him for official record.

Living collections.—For gifts to the Department of plants or seeds, the following are here publicly thanked:—

Lady GUILLEMARD, Mr. K. J. BASK of Mullumbimby, Australia, Mr. E. BATESON, Mr. L. C. BROWN, Mr. G. DAVIDSON (H. B. M.'s Consul at Para), Captain H. BERKELEY, C.B.E., Mr. W. DUNMAN, Mr. L. de COTTA, Mr. H. CUNDY, Mrs. F. FLIPPANCE, Mr. W. J. C. FROST, Mr. P. FEDDERSON, Mr. H. J. ELEY, Mr. F. T. KINDER, Mr. G. P. OWEN, Mr. B. K. SAHIB, Mr. V. G. SAVI, Lieut.-Colonel R. L. B. THOMPSON, C.M.G., Mrs. G. W. A. TRIMMER, Dr. G. H. VERNON of Thursday Island, Mr. WAY, Messrs. AHMED BIN HASSAN, AHMED BIN HADJI OMAR and ABDUL KADIR of Singapore and a number of Malay and Chinese exhibitors who at the close of the Malay-Borneo Exhibition allowed the Department to select from their exhibits; the Royal Botanic Gardens, Kew, Calcutta and Peradeniya; the Botanic Gardens, Buitenzorg, Cambridge, Port Darwin, and Saigon; the Jardin Colonial of Laecken, and Mr. A. ROBERTSON-PROSCHOWSKY of the Jardin d'Acclimatation "Les tropiques" at Nice, the Chief Forest Officer, Zomba, British Central Africa; and the Director of the Amani Experimental Station, Tanganyika territory; the Conservator of Forests, S. S. and F. M. S., and his officers; M. M. ANDRIEUX-VILMORIN et Cie., the Arnold Arboretum, Jamaica Plain, Mass., U. S. A., the Department of Agriculture of the United States, and the Experimental Stations in Hawaii and Porto Rico.

Owing to identity of climate between the south of the Malay Peninsula and the lower Amazon valley, an exchange has long been sought with the Botanic Gardens, Para, but cannot be obtained. In default of this the kindness of Mr. DAVIDSON in sending seeds is greatly appreciated.

Mr. FROST gave to the Waterfall Gardens a large consignment of *Dendrobia* from the South Sea islands in return for assistance rendered earlier in connection with collecting.

Mr. G. H. VERNON's gift of a large plant of *Dendrobium Johannis* was much appreciated. It was exhibited at a meeting of the Singapore Natural History Society and a note upon it will be found in the Society's transactions. The seed of *Widdringtonia Whitei* which the Chief Forest Officer, Zomba, so kindly procured, has given a supply of seedlings: they are being carefully nursed. The Director of the Amani Experimental Station supplied seed of *Vitex Volkensii* which yields a new drug; seedlings have been raised.

Casuarina Rumphii was successfully raised from seed from Buitenzorg. Kew and Cambridge supplied collections of *Kalanchoe*.

The Department brought into cultivation plants from Gunong Tahan, from the Semangkok Pass, and from the hills near Seremban and Gunong Tampin. Further the Director brought back plants from Gunong Gedeh in Java, whither he had gone on short leave in May, and Mr. FLIPPANCE brought plants back similarly from Kedah. The Plants-inward book in Singapore records the receipt of 1,874 plants and 913 packets of seed; and in Penang records the receipt of 2,304 plants and 234 packets of seed.

Hydrangea Hortensia flowered and *Coclococcus carolinensis* fruited in Singapore.

Captain BERKELEY's gift was of seed of a small Rubiaceae shrub used as a substitute for coffee in Upper Perak. The young plants raised are yet too small for determination.

The Royal Botanic Gardens, Kew, sent seed of *Picralima Klaineana*, a tree which provides a widely-used African remedy for fever. At present the seedlings are 6 inches high.

Pests.—Two orchids suffered much during the year from the attacks of beetles: they were *Calanthe veratrifolia* which was attacked by an *Aorocrypta* and *Spathoglottis plicata* which was attacked by a Hispid other than the common *Gonophora*.

A Coccid was bad on *Hibiscus* and a caterpillar on *Cassia fistula*.

A beetle found destroying *Shorca* seed proved to be a species of *Alcides*.

The determinations of the insects above were received from the Honourable Mr. C. J. SAUNDERS.

Dry Collections.—Advantage was taken, as follows, of opportunities of collecting in various parts of the Peninsula. The Director collected at Port Swettenham and in Penang (March 11—20); Mr. MOHAMED HANIFF on Gunong Tahan (May 20th—June 18th); the Director at Port Swettenham and in Penang (June 17th—26th); the Director and Assistant Director together, about Fraser Hill, in Kuala Lumpur, Penang, Province Wellesley and Port Swettenham (September 15th—October 11th); the Assistant Director in Central Johore and Negri Sembilan (November 15th—December 5th); the Director near Kuala Lumpur and in Penang (December 5th—13); Mr. BEST and the Gardens' plant-collectors on Gunong Pulai (April 24th—26th and December 28th.)

Further while on leave the Director made a collection of dry plants upon Gunong Gedeh, Java, which has been incorporated in the Gardens' herbarium.

Mr. H. C. ROBINSON gave very kindly help to Mr. HANIFF when visiting Gunong Tahan.

The following herbarium specimens were sent out:—

to the Royal Botanic Gardens, Kew	...	...	758
to the Bureau of Science, Manila	...	...	718
to the Botanic Gardens, Buitenzorg	...	...	604
to the Prince ROLAND BONAPARTE (ferns for determination)	...	...	296
to Mr. G. C. LLOYD (fungi for determination)	...	...	235
to the Royal Botanic Gardens, Calcutta	...	...	174
to the Forest Department, Kuala Lumpur	...	...	131
to the Arnold Arboretum, Jamaica Plain, Mass.	...	...	124
to the Botanic Gardens, Brisbane	...	...	108
to Mr. H. N. DIXON (mosses for determination)	...	...	100
to the British Museum of Natural History	...	...	99

Carried forward ... 3,347

	<i>Brought forward</i> ...	3,347
to the University of California	...	70
to Professor OAKES AMES, Cambridge, Mass	...	55
to the University of Cambridge, England	...	46
to Mrs. E. SMITH ...	...	30
to Mr. JAMES Groves (Chara for determination)	...	1
	<hr/>	
	Total ...	3,549
		<hr/>

and also 113 hand-samples of timber to nine of the departments or institutes named above.

The help in determining plants given by those named above is gratefully acknowledged, and also similar help from Mr. E. D. MERRILL, Director, Bureau of Science, Manila, and Dr. J. J. SMITH, Acting Director of the Botanic Garden, Buitenzorg.

Coccids have been sent to Professor C. F. BAKER and Dr. HAROLD MORRISON.

Mounting paper being again obtainable, three women have been employed to assist in the mounting of the herbarium collections, in order to reduce the great accumulation of inaccessible specimens. It is anticipated that in 1924 these, which are war arrears, will exist no longer.

Herbarium specimens were received from the Royal Botanic Gardens, Kew (48) being duplicates of a collection made by Mr. RIDLEY in 1920 - 1921; from the Bureau of Science, Manila (1358); from Mr. A. MARCAN (140); Mrs. SMITH (325) and Luang Winit Wanadorn of the Department of Forestry, Siam (64); and lastly fungi to the number of 210 from the Department of Agriculture of South Africa.

Drawings of plants were kindly supplied to the Department by Mrs. NEWNHAM and Miss. A. M. BURKILL; and a photograph by His Excellency Major-General Sir NEILL MALCOLM.

Books and pamphlets were kindly given to the Department by the Colonial Government, the Governments of India, Java, Corea, Formosa, Queensland, South Africa and Brazil; by Dr. DOCTERS VAN LEEUWEN, Mr. J. G. BEAUMEE, Mr. F. M. BAILEY, Mr. D. H. IMMINCK, Mr. G. B. DESHMUKH, and others; and by the Malayan Branch of the Royal Asiatic Society, the Singapore Natural History Society, and the Editor of the Gardens Bulletin and many institutions which regularly send their publications. The books bound were not so many as had been hoped, so that large arrears still exist.

Botanic Gardens, Singapore.

In January the removal of silt from the Lake was finished, but the Limnanthemum Pond was not filled by it. To fill it, the area of the sun-rockery was enlarged, and the site of a second propagating orchid-house dug out: and these, which were works long contemplated, furnished filling. The whole area of the old pond was then planted up with red and yellow cannas, and they became very effective. The sun-rockery was provided with hard sandstone terraces and planted, as far as the Gardens' stock of suitable plants permitted: but it will be some little time before it can be considered as "made," for many plants have to be procured. Late in the year it was arranged that an anti-mosquito vote should meet the cost of filling the Cluny Lake, and work thereon was commenced. The source of the filling is the future site of the Gardens' subordinates' quarters, and the Tamil lines. The lake itself is destined to become a nursery.

By using the glass of old almeirah-doors, a new place was prepared in the potting yard for seed-germination and much is hoped of it: the attaped corner formerly used, was too damp and too dark.

The By-laws of the Botanic Gardens, Singapore, were revised and re-published in the *Straits Government Gazette* of November 10th, 1922. The alterations made declare the Gardens closed at one hour after sundown, **forbid the entrance** of lorries and 'buses, **raise the permissible pace of** vehicles to 15 miles per hour, assert clearly that wild life has sanctuary in them, and define better the controlling authority. As there are two dwelling houses within the Gardens to which vehicles at times need access, a short service road is being laid down by which lorries can reach them and when it is ready the By-law forbidding heavy vehicles entry over the other roads will be strictly enforced.

A violent squall in the early morning of May 9th overturned thirteen trees in the Botanic Gardens and four in the Economic Gardens. Five weeks later some one maliciously uprooted a number of new plantings. Eighteen cases of theft came under investigation and approximately the same number of thieves were convicted.

Planting of the sun-rockery was done in August. One side is given to *Agave* and *Aloe*: the other to succulent Euphorbiaceae, *Cacti* and *Kalanchoe*. The lowest terrace is temporarily filled with *Zephyranthes*. The islet in the Lake, cleared of *Wormia* and planted partly with *Randia macrantha*, was further planted with tree ferns and Vandas. Many waterlilies were put into the lake. The last of the Dell rockeries was planted up.

The number of plants sent out was 10,977 and of packets of seed 217. Two wardian cases were sent out, one to Kew and one to Peradeniya.

The Band and the drums of the 2nd. Middlesex Regiment played regularly in the Gardens, and the Band of His Italian Majesty's ship "Libia" **once**, upon the kind offer of Commander BURZAGLI, C.B. The services of the regimental band were obtained by the kind permission of Colonel F. E. SWAINSON and the officers.

Economic Gardens, Singapore.

The demonstration plots of vegetables were continued until the end of the year, when they were closed down. Cultivation of the fruit-tree plot **upon the hill-top** was abandoned, and preparations made for the removal of some of the fruit trees. The small tree of *Swartzia pinnata*, which is the only one in the Gardens, was successfully transferred to the Botanic Gardens, though it is 12 feet high. Other similar trees have been prepared for removal by root pruning. The observation plots of tuberous plants under study were replanted upon the understanding that the land whereon they are will not be needed for other purposes until after the crops have matured.

There were sent out 7,181 economic plants and 153 packets of seed.

Waterfall Gardens, Penang.

The planting of the block of land outside the Gate which formerly served as a Demonstration Vegetable Garden, is in progress and when the **shrubs have grown**, the amenities of the approach will be restored. When occasion offers, some planting should be done upon the other side of the road also.

Half of the stag-headed *Polyathia* trees of the Lower South road have been removed. In the neighbourhood of this road the stream had fretted its bank seriously and not a little labour has been put into strengthening it. A slipping has occurred at the Upper Dam, but is not serious yet: the slipping has caused the north end of the dam to be about an inch lower than it was originally.

Additional flower-beds have been made, crowning the bank over the stream at this spot.

Pancratium and *Zephyranthes* have been used in the borders round Plant-houses 1 and 3.

The Bathing pool (no longer available for bathing) has been improved considerably by a cleaning out, by additional planting of water-lilies and by a new sluice. *Impatiens Curtisii* and *I. Holstii* do very well on its rockeries, and *Staurogyne grandiflora* has flowered in great profusion.

Warczewiczia coccinea flowered in the Gardens for the first time. *Ouvirandra fenestralis* gave seedlings. *Rhododendron Teysmanii* flowered in the fern rockery.

Five trees were lost: none irreplaceable.

It has become popular with visitors to feed the monkeys which visit the Gardens, and large numbers of cars drive round the Lower roads in the evening, even to well above 100 a night between 5 and 7 p.m. The use of the Upper roads by cars has been forbidden since a serious accident occurred in March. That all manner of visitors should drive to the very top of the Garden had for long appeared undesirable on account of the damage done thereby to the roads and a notice board was put up in 1915 where the Upper South road takes off to direct them along the Lower Roads: but since the accident these upper roads have been closed and blocked by drop-posts. They have been narrowed and are good paths for pedestrians.

The number of plants sent out was 3,429, together with 87 packets of seed: of the plants 1,377 were officially plantings in Government ground outside the Gardens.

Government House Domain.

The year's work in the Domain has been a valuable one because under close supervision an accurate measure of the labour required has been obtained.

His Royal Highness the Prince of Wales planted a Royal Palm on the lawn.

Roadside Trees and Parks.

The arrangement with the Municipality of Singapore by which help is given with their roadside trees and park-lands is gradually taking shape; and that with the Municipality of Georgetown, Penang, is in full working order. Not a little new planting has occurred in both Settlements upon Government land. Many officers have the use or control of land on the understanding that they do not remove trees without permission; but as no inspection has existed, trees in the past have been removed unsanctioned. An inspection can be provided for now on the filling of the post of Assistant Curator, Parks.

Angsana disease has removed all the *Pterocarpus* trees from the Tanglin Barracks grounds, except three which are isolated.

Other Work.

The Director of Gardens, and the Assistant Curator, Waterfall Gardens, Penang, have been gazetted Inspectors under the Agricultural Pests Ordinance, 1918, with the intention that they should assist in the exclusion from the country of plants liable to bring in with them pests; and also they are empowered to give certificates of freedom from disease on plants exported to countries where such certificates are demanded in order to obtain import.

Much work was done for the Malaya-Borneo Exhibition chiefly in laying out the grounds, loaning plants, carrying through the Horticultural Section and furnishing two stands one to advertise vegetables and the other to advertise fruit trees. Also a considerable amount of decorating of public places both in Singapore and Penang was done by the Department during the Royal Visit.

SINGAPORE, 27th February, 1923.

I. H. BURKILL,
Director of Gardens.

Conserved by



